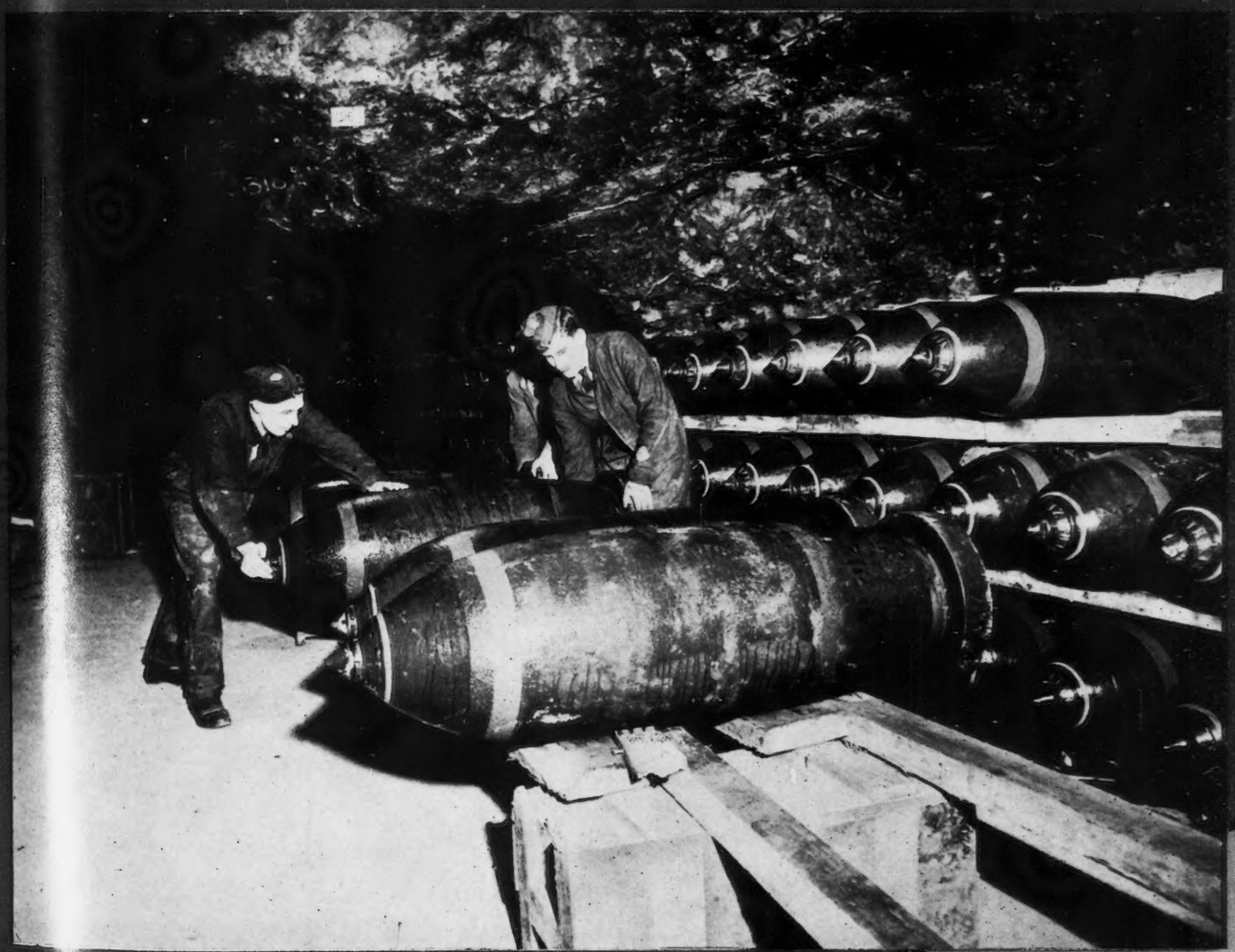
ENGINEERING AND MINING JOURNAL

MARCH, 1942



Rolling 2,000-lb. bombs to storage ou-racks in a disused mine tunnel somewhere in England

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A MINING TOUR OF SOUTH AMERICA—I
Particle Sizing in Phosphate Recovery
Motors in a Fluorspar Plant • Gold from Venezuela
Underground Turnouts • New Electric Roasting Furnace
Economy by Metallizing • Placer Valuation—III
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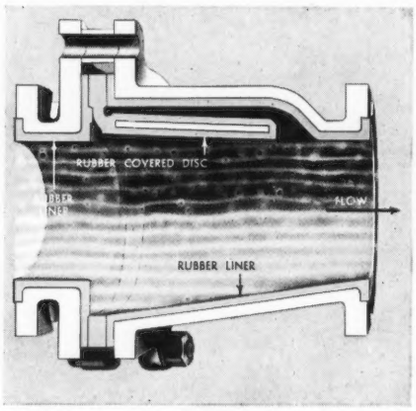

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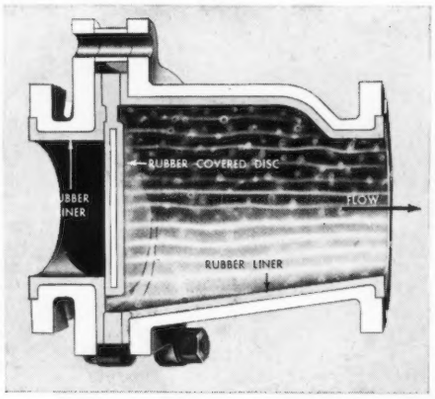

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INCLINED FLOW

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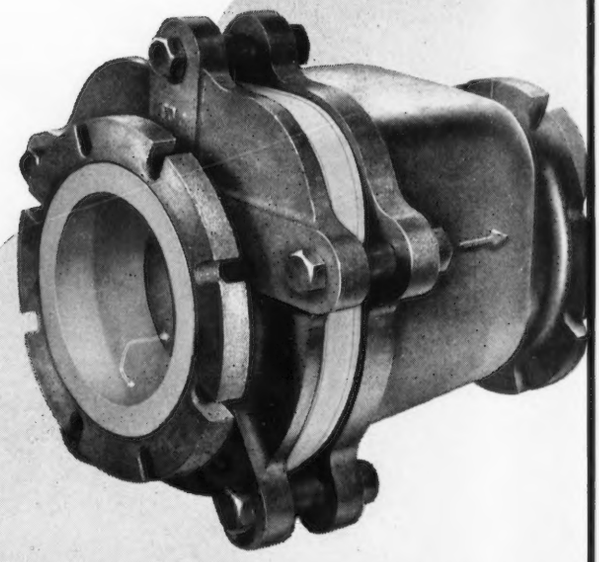

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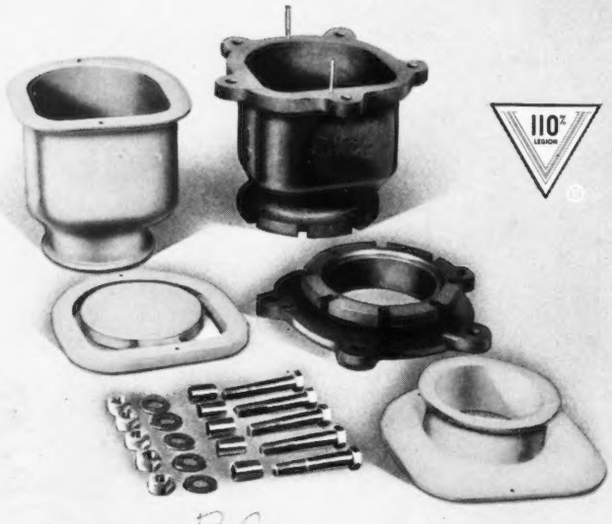

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P.G.

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In the Philippines. Severance of the mining industry in the Islands from the outside world as a result of the Japanese invasion finds *E.&M.J.* with various articles dealing with operations, in Luzon and elsewhere, on its editorial hands. These contributions are technical in character and, from that viewpoint, are as useful today as when they were clicked out on the typewriters of their respective authors. Two of them will appear in March. The first deals with the gold-dredging operations of Coco Grove, Inc., a Marsman enterprise that is of especial interest because of certain features of design that characterize the boats. The writer is G. R. Johnson. A shaft-sinking job in the same district will be described in the second article by J. C. Alexander, mine superintendent for United Paracale.

▼

Salvation from salivation in the Contact quicksilver mine in northern California and how it is made possible is the subject of Thomas Soule in an article also scheduled to appear next month. Mercury poisoning affecting the salivary glands, is one of the hazards of mining this elusive metal when it occurs in native form, and indeed it must be guarded against in amalgamation plants and elsewhere, wherever workmen may be exposed to its harmful vapor or get the substance on their hands. The remedy at the Contact mine appears to be an inexpensive chemical spray devised by a member of the faculty of the University of California.

▼

Bills suspending certain assessment work on mining claims have been introduced in Congress. One of them would lift the requirement of $100 worth of labor annually on claims in the U. S. and Alaska within the limits of any area withdrawn by executive order. Another bill would suspend work required for the year ending July 1, 1943, on claims held by persons whose income is not sufficient to require payment of a Federal income tax in 1942.

H. C. PARMELEE
Editor

ENGINEERING AND MINING JOURNAL

H. W. CLARKE
Vice-President

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COVER ILLUSTRATION: Rolling 1,000-lb. bombs to storage on racks in a disused mine tunnel somewhere in England. British Press Combine Photo

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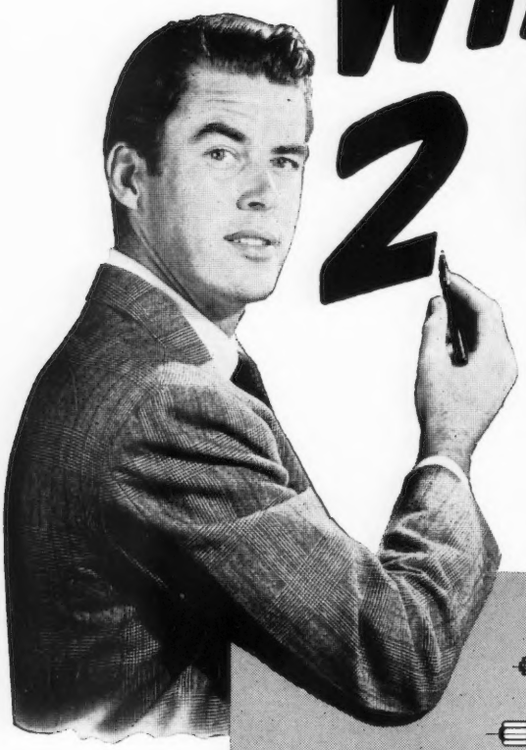

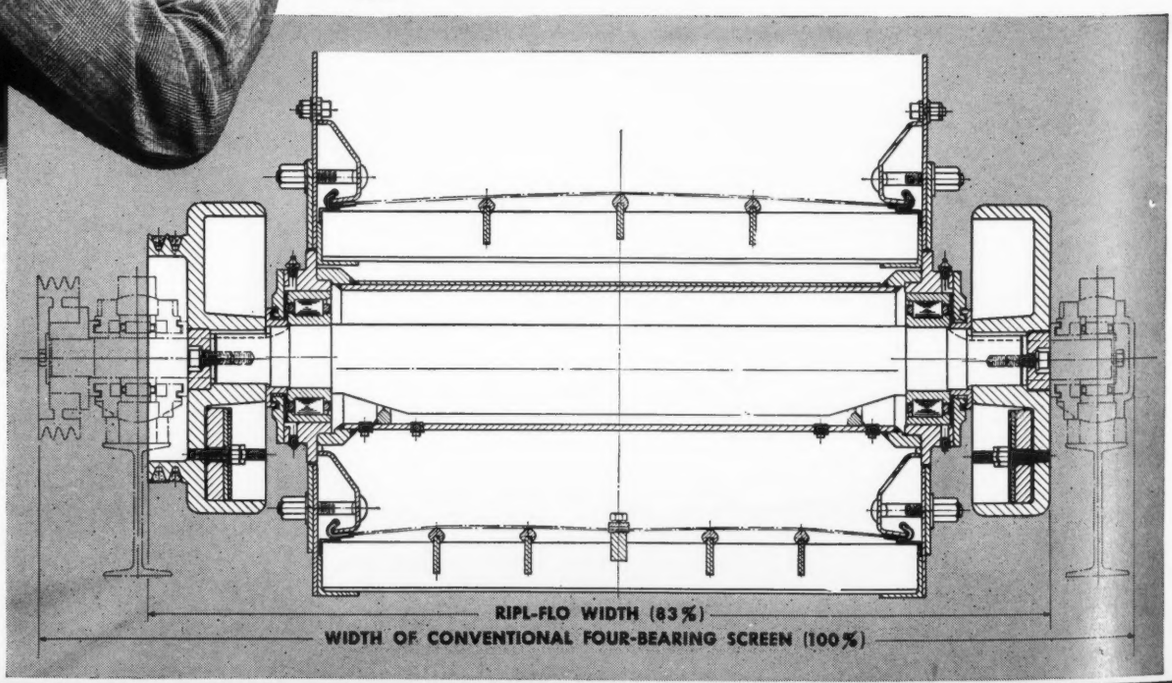

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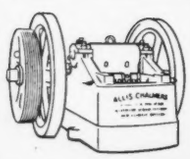
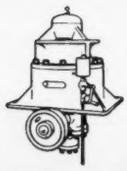
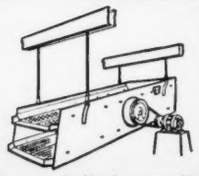


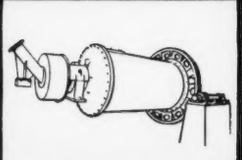
Jaw Crushers—Primary and Fine Reduction



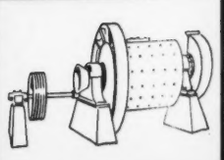
Type "R" Crusher with "Speed-Set" Control



Low-cost, High-capacity Ripl-Flo Screen



Rod Mills for Uniform Coarse Grinding



Ball Mills — Efficient Fine Grinding

ENGINEERING AND MINING JOURNAL

H. C. PARMELEE, Editor

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Volume 143 MARCH 1942 Number 3

Maintenance in the Limelight

TWO CONSEQUENCES of the war are emphasizing the vital importance of the maintenance function in mining and metallurgical plants. One is the necessity of avoiding lost time—of keeping the wheels turning so that maximum metal production will be obtained for the fabrication of war machines. The other is the relative shortage of supplies and equipment which makes it necessary to keep existing machinery in service at a time when normally it might be discarded and replaced. Fortunate is the company, especially in the smaller class, that has able mechanics and electricians. Their ingenuity in making repairs, in substituting materials, in adapting the means at hand to the emergency of the moment, will frequently mean the difference between a costly shutdown and continuous operation. The war brings into sharp relief the value of a group of men normally working in relative obscurity and whose contributions to production are frequently taken for granted. They now have opportunity for conspicuous service in the national emergency.

Watch Mr. Morgenthau

IN AN ADDRESS at Cleveland, Ohio, on January 24, Secretary of the Treasury Morgenthau publicized "four specific examples of tax loopholes . . . which have been allowed to remain on the statute books at the expense of the majority of our taxpayers." Now, his use of the term "loophole" connoted special privilege, subsidy, or evasion that ought to be stopped. So when he named percentage depletion as one of the tax loopholes that ought to be plugged, he pilloried the mining industry as an offender against the public welfare, and unfairly prejudiced its case for special consideration in computing income tax. The simple fact of the matter is that a mine is a wasting asset, and that in its operation provision must be made for the return of capital invested in a natural resource that is being exhausted. Otherwise, capital as well as income will be taxed.

But Mr. Morgenthau has given notice that percentage depletion allowance will be opposed by the Treasury, and it is up to the mining industry to defend its position. Here is a case where logic must be supported by political pressure. It will not suffice to rely on the able presentations of the American Mining Congress. Mining men as individuals must be diligent in lining up their representatives in the Congress in opposition to the Treasury's attitude. Local mining associations also must be active in forestalling this threat. It will take more than logic to meet Mr. Morgenthau's specious emphasis on national unity, the morale of the people, and the victory of our cause in this war, with which he dresses up his attack. Sheer weight of public opinion on your Congressman will have vast influence in determining the outcome.

Premium Price Plan

FEBRUARY passed without announcement of quotas for the administration of premium prices for over-quota production of copper, lead, and zinc which went into effect February 1 for a period of two and one-half years. Evidently the procedure, which the industry long since expected to be an accounting headache, is also puzzling the administrators. And well it may, because the industry is full of special cases that will suffer injustice if a single plan is adopted without exceptions. We foresee opportunity for endless controversy and disappointing increase in production.

The first hurdle is the establishment of quotas on a monthly basis on which premium prices will be paid for over-quota production. The plan for five distinct classes of quotas, and the rules and regulations laid down in the joint statement of WPB and OPA indicate the complications foreseen by the sponsors of the plan. It will not be a simple matter to determine fair quotas. If some mines in which production has been declining are handicapped with quotas equivalent to their 1941 averages, they will continue to fall below expected production. Only special consideration will enable them to keep going, to say nothing of increasing output.

The sentiment of the mining industry on the

subject was clearly expressed in the resolutions adopted at the annual meeting of the American Mining Congress last month, in which the industry pledged its sincere cooperation in a plan of which it was skeptical and which it politely disowned. Generally speaking, the industry believes that a small rise in the controlled prices for copper, lead, and zinc would have been more effective in bringing out lower-grade ores and increasing production, and that abnormal profits of large companies would have been taxed away.

Quicksilver is the prime example of metal production stimulated by price. Rising from $88 per flask, New York, in September, 1939, to $202.50 in February, 1942, the price stimulated domestic production from 18,633 flasks in 1939 to 44,000 flasks in 1941, the largest since 1883 and ample for domestic needs. Not until that point was reached was a ceiling put on the price. Some comparable philosophy could have been applied to the major non-ferrous metals, but the authorities elected to adopt an untried experiment in a time of emergency. The mining industry can only offer its sincere cooperation.

Greeks Bearing Gifts

SECRETARY ICKES has never shown himself to be a special friend of the mining industry. So when he issues two voluminous releases telling the people how his Department of the Interior expects to save the country by "a proposed expansion program of mineral and power developments in the United States," and "a seven-phase plan of activity to serve in mobilizing strategic natural resources of the Nation," one examines the documents carefully, even skeptically. Do his grandiose proposals genuinely "look toward the rounded development of the West," or do they cleverly involve plans and policies that would extend Mr. Ickes' political control over the country's natural resources? One suspects a mixture of motives, definitely including the latter.

The Secretary sees three bottlenecks in the expansion of our mineral production, and he proposes to break them by means peculiarly his own. The first is to obtain widespread and general use of new processes devised by the Bureau of Mines for the treatment of low-grade strategic ores. Pilot plants and development laboratories are to be erected for this purpose. And in order not to overlook any good work that might, perchance, have been done outside the Government, he would like authority to examine the patented processes and development records of private industry for the confidential use of the Bureau of Mines!

The second bottleneck is in the production of not only strategic minerals, but also some of the common ores. "Pilot plants are proposed for the development of processes for economical extraction of such metals as copper, lead, and zinc from our abundant resources of low-grade ores." Exploration, yet to be authorized, would be conducted by the Bureau of Mines and the Geological Survey with the assignment of 250 additional engineers; and if they could not be obtained under present competitive salaries in private industry, Mr. Ickes would appeal to the colleges and universities to give the Government a year's service of their engineers for this purpose!

The third bottleneck is capital for the development of the Secretary's enterprises. And here Mr. Ickes is on familiar ground and has a ready solution—use public money. The Department of the Interior would certify to the Reconstruction Finance Corporation for loans to companies or individuals seeking to develop low-grade ores or to build mills and smelters. And if private parties didn't care to be certified for loans, Mr. Ickes would "allow the Government to develop the mines or custom mills or refineries" on the same terms as offered to private citizens.

Mr. Ickes expects to draft legislation to break the financial bottleneck. He would also accomplish such other purposes as the creation of a Minerals Policy Board to advise him; the formulation of a leasing system; and the initiation of regional marketing studies to ascertain the capacity of local markets to absorb products fabricated from local minerals.

The leasing system is known to be one of Mr. Ickes' pet ideas, and one which is particularly obnoxious to the West that he wants to "round out." A further clue to one of his aversions is found in his desire to produce magnesium "by processes not privately controlled," and which will insure a post-war industry "on a non-monopolistic basis." All save government monopolies are abhorrent to the Secretary.

And there is much more in the same vein, predicated mainly on the past, present, and future activities of the Bureau of Mines and Geological Survey. How unfortunate that these two excellent technical organizations should be under the dominance of the present Secretary of the Interior. His pronouncements are a weird mixture of ideas—good and bad, new and old, original and second-hand. But by the time he gets through he has the future mineral development of the country pretty well controlled by government ownership and operation. And the odor of politics lingers long after the good points of his "five-year plan" are forgotten.

Reflections from Washington

By Special Correspondent

MAXIMUM PRODUCTION of metals is necessary. Perhaps there is no more important single maxim about Washington than this one. The ultimate magnitude of military effort which the United States can make depends on the quantity of metal available.

Mere multiplication of military production is not practical. To serve our own and allied armies, containing perhaps ten million men in uniform, we may not merely multiply our original program for two million men by a factor of five. In the first place, we do not have raw material enough to do this. In the second, we do not have metal working and manufacturing facilities to correspond. Third, and most important, the need does not multiply equally for all kinds of goods. Unfortunately, the need for metal products increases much more rapidly than the others.

These facts explain the present Washington effort to give every incentive and every assistance to mining and mineral industries in their production job.

Over-Quota Metal

DURING FEBRUARY the mining industry had its first experience with premium prices for over-quota production of copper, lead, and zinc. The premium prices previously announced were 17¢ per pound for copper, 11¢ for zinc, and 9.25¢ for lead. To provide the bonus above "ceiling" prices, the purchase of the surplus metal is to be made by Metals Reserve Co., which promises to pay the premium rate for at least two and one-half years from Feb. 1, 1942.

A quota is established for each mine or group of mines to cover normal expected production without bonus. Where increased output was being planned, or could have been planned at normal prices, there is no extra payment for that quantity of production. In other words, the output which could reasonably be expected at the established market price is within the quota.

Quotas are on a monthly basis. Each company is required to keep complete records of output to demonstrate over-quota production. It is not necessary that the over-quota metal be actually sold direct to Metals Reserve each month. A record demonstrating over-quota sales at normal prices will entitle the producer in a subsequent month to sell equivalent metal for the bonus price, the whole series of transactions to be clearly provable by audit by the government.

If the need for over-quota production should terminate within less than 30 months, Metals Reserve has the right to cancel the present arrangement "on equitable terms." But Washington does not take this hopeful precaution too seriously, since there is no clear evidence that war requirements can possibly terminate sooner.

Any firm having under-quota output for one period, or in one of its several mines, must make up the under-quota quantities in subsequent operations or from other mines before it gets bonus payment on what is demonstrably a net over-quota. In the event of catastrophe, like fire or flood, which makes quota production impossible, a firm is allowed some special relief from this make-up requirement.

Conversion

THE OBJECTIVE of WPB is to get maximum production from present facilities. This means that for manufacturing industry many plants must undergo "conversion" from peace-time goods to the making of military equipment. Such change-over will be practically forced by the limited allocation of metals and other scarce materials to any plant making only peace-time goods.

Although mine conversions cannot be made, the same general ideas about increased output apply to mining as to manufacturing. Every plant should work to its maximum of capacity. No machine may be idle if the product of that machine is wanted. This means that 168 hours per week is the expected work period at every station for manufacturing, mining, or other service, wherever possible.

Under this program many more men are being forced on to second-shift and third-shift jobs. Longer hours per man per week are expected. Every other device practical for *greater output without new equipment* is to be utilized.

And the maxim of Washington is "Convert or perish."

New Magnesium Processes

THE QUANTITY OF METAL scheduled for production in the United States is being increased in the case of almost every metal. Goals for magnesium, aluminum, tin, manganese, and a dozen other metals have been raised significantly since the first of the year.

The government-financed tin smelter being built in Texas will be approximately three times the original size planned. It is hoped that it can operate for production of at least 52,000 tons of metal per year. To give that capacity at the earliest possible date, a priority rating of A-1-a has been granted. Supplies of Bolivian ore will be greater than originally planned, because of the necessity for conserving shipping space. The short haul to Texas is much to be preferred, even by the British, to transatlantic haul under present difficult conditions.

Several new primary aluminum plants are being arranged for. Several of these are to be in metropolitan areas of Central or Eastern states where the required electric power will be provided from existing public-utility systems. If necessary, commercial and household users will be required to cut their electricity demands, especially at peak loads. There has been no official announcement of the exact total of the new goal for aluminum. But there is no secrecy about the fact that it is more than a third above any previously mentioned figures.

The magnesium goal has also been raised much higher, perhaps to double any previously announced figure. This is necessary to meet the huge incendiary materials requirement which increased aerial warfare has imposed on the United Nations. Increased production of planes, which takes additional magnesium for light metal parts, would not nearly account for the huge production desired.

New Metal Production Goals

THERE has been much loose talk in the daily press about new magnesium processes. Some such new technical developments are being utilized for several of the newest contracts being negotiated by Defense Plant Corporation. There is no official announcement regarding details; but it is well known among technical men that pilot-scale units have been operating in a number of works during the last year or two.

Definite release has been given of information regarding the new electrolytic process devised by Mathieson Alkali Works, in conjunction with Consolidated Mining & Smelting Co., of Trail, B. C. This new process uses magnesium cloride made from dolomite by calcining and subsequent chlorination. The essentially new feature is the modified type of electrolytic cell. It has the great advantage of producing metal and simultaneously giving chlorine in a recoverable concentration. Thus, the process differs from earlier methods in that it furnishes a surplus of chlorine for sale instead of being a chlorine-consuming process, considered over-all.

Most extravagant claims are probably those made by irresponsible news writers for the new methods of reducing magnesia with ferrosilicon. That is not a new idea; but substantial experimentation of recent date has been made. The result is at least one, probably two or three, new technics of great importance, which will be incorporated in the plants being erected under contracts negotiated during February and March. The raw material is dolomite. This is calcined and then briquetted with ferrosilicon before retorting. The great advantage for present war conditions is the fact that this type of process uses a minimum of electric power per ton of magnesium produced, even when including that required for the manufacture of the ferrosilicon.

Depletion Rule Hit

SECRETARY OF THE TREASURY MORGENTHAU is again pressing for a closing of the depletion "loop hole" in the present tax laws. It remains to be seen whether Congress will finally yield to his argument as the new tax program develops this spring. The Secre-

tary is quoted on this subject, from recent speech in Cleveland, as follows:

"The final loophole which I shall mention this afternoon is one against which the Treasury has struggled for years without avail. If you use a machine in your business and that machine can be expected to last for ten years, you are permitted to deduct each year for ten years one-tenth of the cost of that machine. Because you will probably have to buy a new machine at the end of ten years, this deduction is a fair and reasonable method of allowing you to recover your capital. Needless to say, you are not permitted to deduct more than the cost of the machine.

"But you may be surprised to learn that this is not true of mines and oil wells whose owners are permitted over the years to deduct far more than the amount of money which they have put into the property for the conduct of their business. The so-called percentage depletion provision of the income-tax law allows these companies, not simply to deduct a percentage of the cost of their wells and mines each year until the entire cost has been made good, but to deduct an arbitrary percentage of their income indefinitely."

Mine Machinery Exports

UNCLE SAM intends to share his scarce materials and scarce machinery with the "good neighbors." Approximately the same argument and procedure gets a priority for a Canadian or Latin American mining or mineral enterprise as for one in the United States. Actually the WPB maintains what is in effect a branch office for priorities at the office of the Department of Munitions and Supplies, Ottawa.

Amendments have been prepared to the rules regarding repair and maintenance priorities (P-100) which permit comparable action for a Canadian firm with respect to emergency repairs or essential stock of repair and maintenance parts and material.

The cooperation with Latin America has not gone quite so far. However, allocations of machinery are being made wherever official Washington decides that it wants scarce raw material like nickel, asbestos, manganese, or other strategic materials. Probably this procedure stimulating South American developments would have gone much farther already were it not for the limited shipping space available, both to take American products southward and to bring Latin American materials to the United States.

Self-Appointed Saviour

SECRETARY ICKES admits that he is going to convert the whole Department of the Interior into a war agency. He proposes a seven-part plan of activity which, one might think from the press releases, would solve several of the nation's greatest shortage problems. In published statements from the middle to the last of February, the Secretary sets forth the following nine proposals:

1. To secure the immediate use of new processes discovered or tested in its own laboratories which can supply enough manganese.

2. Establishment of plants using the Department's improved acid process for producing aluminum.

3. To explore for copper, zinc, lead, iron, and other metals and to speed explorations for chromite, bauxite, etc.

4. To speed exploration for vanadium, tungsten, and mercury sources . . . and to propose properly located custom mills. To increase output of sponge iron; to develop processes for low-grade copper, nickel, lead, and zinc ores, etc.

5. To review the private and confidential drilling and mining records of all individuals through the Bureau of Mines, and to stimulate college and universities' aid in engineering explorations.

6. To investigate patents, apparently with a view to making these available to others than their present owners.

7. To round up new metal resources "by encouraging scientists and educational institutions to place in the hands of metal men, prospectors, science teachers, and others in likely areas, charts describing minerals needed for war. . ."

8. To advise W.P.B. "with a ranking of the best possible new developments of critical materials," and "formulate for WPB a domestic ore-buying program." And "to stand ready to supervise it if requested."

9. To protect mining and all forms of industrial production by control of the handling of explosives through licenses.

The announcements for the daily papers are apparently phrased to give the public the impression that no one has previously been doing any of these things.

News "Fines"

Nickel-less Nickel—The new five-cent piece will be half silver and half copper. Thus, the popular nickname of this coin will be misleading. It will no longer contain nickel.

Hours Worked—Time taken by workmen to change clothes, either on arrival or departure from work, is to be included in "hours worked" under Wage-Hour rulings.

New War Powers—Under the second War Powers Act, which seemed likely to go onto the statute books early in March, the Government has power to take over machinery and equipment of one establishment and move it to another for war purposes.

Fuel Shortage—Shortage of petroleum on the Eastern seaboard is now real. The worst forecasts of Secretary Ickes of last fall seem likely to be greatly exceeded, but not for the reasons he then gave. Recent tanker sinkings are the cause. The effect on mining and smelting firms may be significant.

Relaxing Labor Rules—Washington repeatedly calls on labor to cooperate in war effort. It is even suggested that too rigid enforcement of overtime rules under employment contracts should not be insisted on. Up to the end of February, there was no evidence that either labor leaders or high officials thought that time beyond 40 hours should be worked at normal rates. The 48-hour week is urged, sometimes a longer one; but overtime rates are assumed applicable, except in some cases for Sunday and holiday employment.

Explosives Regulator—The Bureau of Mines has named C. E. Nighman as chief of the Explosives Control Division. He will have direct administration of the Federal Explosives Act which provides that all firms and individuals making, distributing, storing, or using explosives shall be licensed. The new division headed by Mr. Nighman will be a part of Health and Safety Branch, U. S. Bureau of Mines; and it will have its headquarters at the Washington offices of the Bureau.

Copper Leaks—WPB officials think that considerable copper is being bootlegged into products not now permissible. Plant-to-plant investigations are contemplated. Severe penalties will be imposed on violators.

Silver Buying—Secretary Morgenthau says, "So far as I am concerned, I will be glad to see Congress strike all of the silver legislation on the books." This is another evidence that the silver-buying program has boomerang characteristics. It is not likely that Congress will take the Secretary's advice, but some restriction on silver purchases may develop later in the spring.

Tires for Mines—Certain mining enterprises may not be able to get necessary tires through local or state rationing boards. Where shortage of such equipment threatens to interrupt strategic mineral supply, direct appeal to War Production Board is desired.

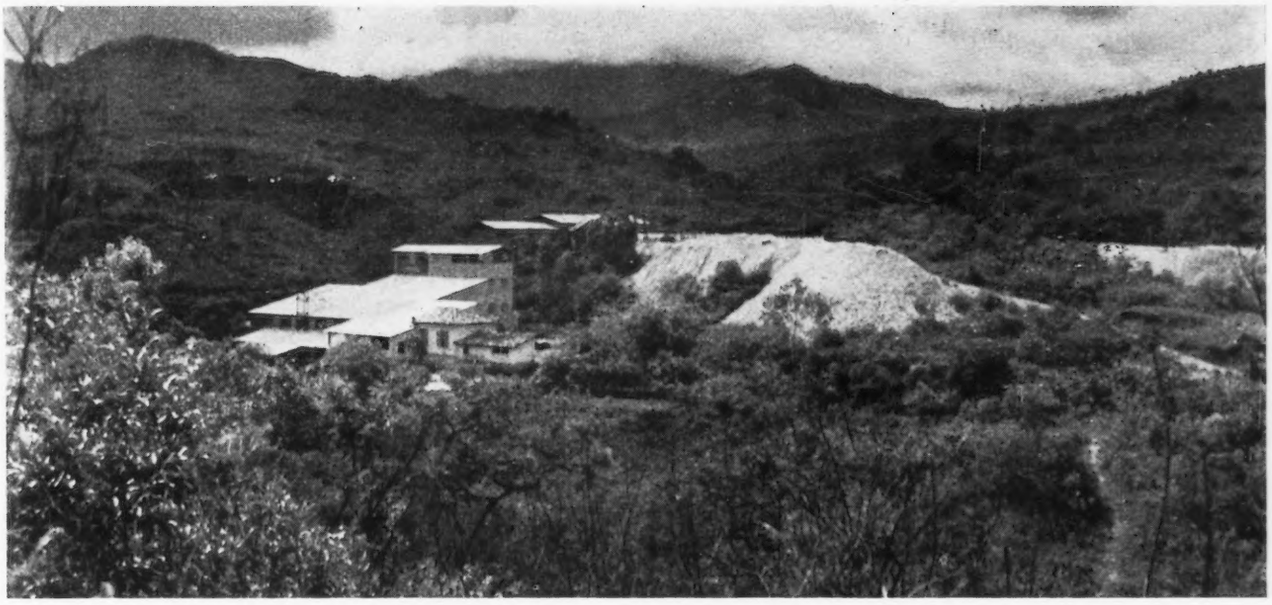
Mineral Tariffs—Vigorous protest has been made by representatives of the mineral, textile, and agricultural interests against some important proposed cuts in tariff rates. The mining industry is particularly concerned with the negotiations with Peru, as they affect present duty on tungsten of 50¢ per pound of metallic content and on bismuth, dutiable at 7.5 percent ad valorem. Members of Congress from the mining states have appeared in protest against the possibility of cutting these duties by 50 percent.

Graphite Restriction—Imported Madagascar flake graphite may now be used only for the making of crucibles to be used in war effort.

Salary Limits—Some government officials are concerned at the high salary rates being paid on jobs where the plants are owned by the government—Defense Plant Corporation, for example. It is being seriously considered whether a top limit on such salaries will not be placed.

Government Ownership—In Secretary Ickes' proposals for new mining enterprise and new custom smelters, he expresses "reluctance" that the government might have to operate such business, presumably through the Bureau of Mines. But the general set-up proposed is such that it appears to insure not only government ownership but also government operation of any activity which may possibly develop from these extreme proposals by Mr. Ickes. The defense of private enterprise thus is regarded generally as purely lip service. Hardly less startling is the proposal by Secretary Ickes that the Interior Department have the right to certify to RFC projects for loans under which low-grade ores or new enterprise would be developed at government expense.

Quicksilver Orders—Complete regulation of quicksilver prices, as well as distribution, was ordered during February. The prices are fixed as ceilings; in some instances they may also become minimums.



A distant view of the Juca Vieira mill, in Minas Geraes

A Mining Tour Through South America

E.&M.J.'s representative starts his journey in Brazil

John B. Huttl
Assistant Editor

WE LEFT MIAMI, Florida, on Dec. 16 last, at 7:15 in the morning, on one of Pan American's four-engine Sikorsky flying boats for San Juan, Puerto Rico. At 10.30 a.m., we landed at Antilla, Cuba, and, after refuelling the ship, took off 30 minutes later for Port au Prince, Haiti, landing there at 1:15 p.m., where we stayed 25 minutes. The same afternoon, at 3 o'clock, we arrived at San Pedro de Macoris, Santo Domingo, after a smooth trip over the highlands of Haiti. Continuance of the trip would have meant a landing at our destination in Puerto Rico, after dark; so orders were received to stay until morning at San Pedro.

As the only hotel in San Pedro is owned and operated by an Italian on the black list, all passengers, after undergoing a rigid inspection at the Custom House and being provided with the *cedula* necessary to travel in the country, were driven to Ciudad Trujillo, about 75 km. away. The well-oiled road traversed many rich sugar-cane fields, plantations, and cattle ranches, with a billboard here and there advertising Pabst beer, Coca Cola, and other well-known American beverages. After a 90-minute trip we were handed over to the genial owner of the Fausto Hotel, Don Ernesto Benitez, who did his utmost to make his guests comfortable. Accommodations and food were good.

All people with whom I came in contact were friendly, and all seem to possess a great sense of humor. For instance, while crossing a wide avenue in the taxi I noticed a large, white obelisk pointing to the sky. I said to the driver that it looked much like the Washington monument. He immediately replied, *"pues si, senor, es el hijo."* (Why, yes, sir, it is the son). The avenue, incidentally, bore the name of Avenida Washington.

Everything is "Presidente"—Presidente Beer, Presidente Hotel, etc., and the neon sign on the roof of the city hall read *"Trujillo para siempre."* Incidentally, little beer was consumed that night by the passengers, the sole reason being the price, which was 45c. a bottle.

We were to be called at 3 a.m. to arrive in San Pedro at 5, but in my case this was done at 2 o'clock by two roosters, one a lyric tenor and the other a basso profundo, and a donkey. Don Ernesto wished us "happy landing" at 3:25 a.m. The fact that I had told him that his son whom he presented to me was *"el vivo retrato de el"* (the living picture of him) might have been the reason that I had landed the best room in the house. We boarded the plane at 5:45 a.m., and a few seconds later took off for San Juan, Puerto Rico, arriving there three hours later.

As San Juan and Trinidad are both defense areas, I shall refrain from giving descriptions or impressions. As luck would have it, the Boeing Strato Clipper was one hour late, with a cancellation occurring in the meantime. When the Clipper arrived, the captain told me that he could take me straight through to Rio de Janeiro. We left San Juan at 2:15 p.m. and landed in Trinidad a little before 6 o'clock. After completing customs formalities, we were driven to the Queens Park Hotel, a modern, comfortable hostelry.

The plane took off exactly at 8 the next morning, and after a smooth nonstop flight lasting nearly eight hours landed at Belem, Brazil, at 4:45 p.m.

Portal of incline shaft used for hoisting ore at Juca Vieira mine

Though we were flying at an altitude between 13,000 and 14,000 ft., we could clearly see the jungle areas of British, Dutch, and French Guiana. However, the plane flew too far inland to enable us to see Cayenne and Devil's Island. We crossed the Equator at 2 p.m., the captain dipping the ship, and were over the Amazon at 2:45. The river itself is a very wide band of brown water, and the delta proper consists of an intricate network of large and small tributary rivers. Belem is several miles distant from the modern airport, and is the jumping off place for the upper Amazon river area. I was prepared for some terrific heat, but to my surprise the temperature in the evening was cooler than that in Santo Domingo.

Belem, capital of the State of Para, is surrounded by dense jungle, and as a consequence is exposed to all evils of the jungle. Some 300,000 people live here. Street-car and bus services are good, though some of the equipment is obsolete. Electric service also is good, I was told by an American of many years' residence. The drug stores seem to do a land-office business. I saw a steady stream of customers enter and leave, all buying some sort of pill or tonic, sometimes in minute quantities. The people were friendly.

We were put up for the night at the Grande Hotel, an old-fashioned affair, and I had to share a room with a fellow traveller, and slept on a small cot. A full house was the reason given. Yet, when I took a stroll after dinner I noticed only two blocks away a building in modernistic style, and going near I saw that it was the Central Hotel. It was an up-to-date affair, and quite new. What a hold-up the Grande Hotel people put over did not come home to us until we settled our bills next morning. I was charged 74 milreis, or nearly $4.25, for a cot, dinner, and breakfast. The mineral water was charged extra. The other passengers were charged up to 90 milreis. I heard some new and fancy swear words, both in English and Spanish. One passenger, a Swiss from Rio, stayed at the Central and was charged 50 milreis for a modern room with bath, dinner, and breakfast.

We arrived at the airport at 6 a.m., on Friday, Dec. 19, and boarded the Douglas plane for Rio de Janeiro at 6:30 a.m. The ship followed the Rio Cut-Off, stopping only once, at Barreiras, to take on fuel. The Barreiras (barrier) airport is unique. It is on a large table or mesa with steep cliff-like walls several hundred feet high, and a narrow road zigzagging along the cliffs affords access to it. Only three white men are here—the airport manager, meteorologist, and a mechanic. During the trip it was interesting to observe the gradual change in vegetation as the plane sped due south. First dense jungle, then areas with woods and grazing lands, and finally the pampas. Before reaching Barreiras we flew over a series of low sierras, and in one I noticed a replica of the Grand Canyon, in miniature, of course, Colorado River and all. This river deserves the name Colorado, for it is blood red. We landed at Barreiras airport at 11 a.m. and left soon after.

After an hour's flight we entered the State of Minas Geraes, the scenery below reminding me very much of the foothills along the Mother Lode in California in April and May. Bello Horizonte looked like a charming town, and the hilly approach to Rio I shall never forget. The plane suddenly leaves the top of a mountain range and below is Rio as if conjured up by magic. We circled around Sugar Loaf Mountain and the statue of Christ the Redeemer, finally landing at the airport at 4:20 p.m. Rio is perhaps the only city in the world where the airport and steamer landing piers are practically in the center of the town. It took the taxi less than 4 minutes to get me to the Hotel Central, on the beach and facing Sugar Loaf Mountain. The Brazilian officials were courteous and efficient, but woe to the individual who has not the proper paper in his possession. Nothing can be obtained without proper identification. The hotel is comfortable, but the help is unattentive and sometimes rude.

I called at the American Consulate General, where I registered, and met Mr. Pardee, foreign minerals specialist, U. S. Bureau of Mines. One sees a great future ahead for Brazilian mining. It is a long-range program of education. Advancement can be brought about (1) by one or two American companies operating under Brazilian laws showing the local people what can be done by applying modern methods to mining and milling operations; and (2) sending young Brazilians, who have studied mining here for two years, up to the United States to complete their work and obtain practical knowledge. Few companies so far have asked for help and advice. Labor is cheap; hence mechanical equipment is going in slowly.

The American machinery houses here all are planning long-range programs, for, in spite of the fact that Brazil can absorb unlimited quantities of equipment, it cannot be forced on too fast. Roads, better laws, and reasonable freight rates will play an ever increasing part in the development of the Brazilian mining industry. Roads in particular are needed, and it is my belief that the makers of road machinery will be the first to enter the Brazilian equipment field. Development of natural resources will have to be done on a profit-sharing basis in view of the nationalistic laws; and closer relationships between American business men and local business, based on mutual understanding, will do more than several thousand goodwill ambassadors.

Rio is one of the most beautiful cities I have ever seen, but was very, very hot at the moment. I was told that there would be no let-up until April. Few luxuries from Europe can be seen in the shops on Avenida Rio Branco, Rio's Fifth Avenue. Most of the merchandise is American. The German Condor air line has closed down. Lati, the Italian company, is still operating.

Despite two holidays during Christmas week I accomplished quite a bit in contacting local business men and members of the Brazilian Bureau of Mines. Individuals interviewed included G. N. Baudin, of Ingersoll-Rand; Samuel Weis, assistant vice-president, and John H. Morrison, local manager of Bucyrus-Erie Co.; Luciano Morais, director general; Dr. Glycon de Paiva, director; Dr. Mario da Silva Pinto, laboratory director; Ing. Jayme Araujo, in charge of the ore-dressing laboratory; and Prof. Fritz Feigl, a

refugee from Vienna, who handles the micro-chemical end of the laboratory, all active in the Bureau of Mines. Dr. Morais is the one who secures the necessary funds from the Government. Dr. Paiva is a brilliant worker.

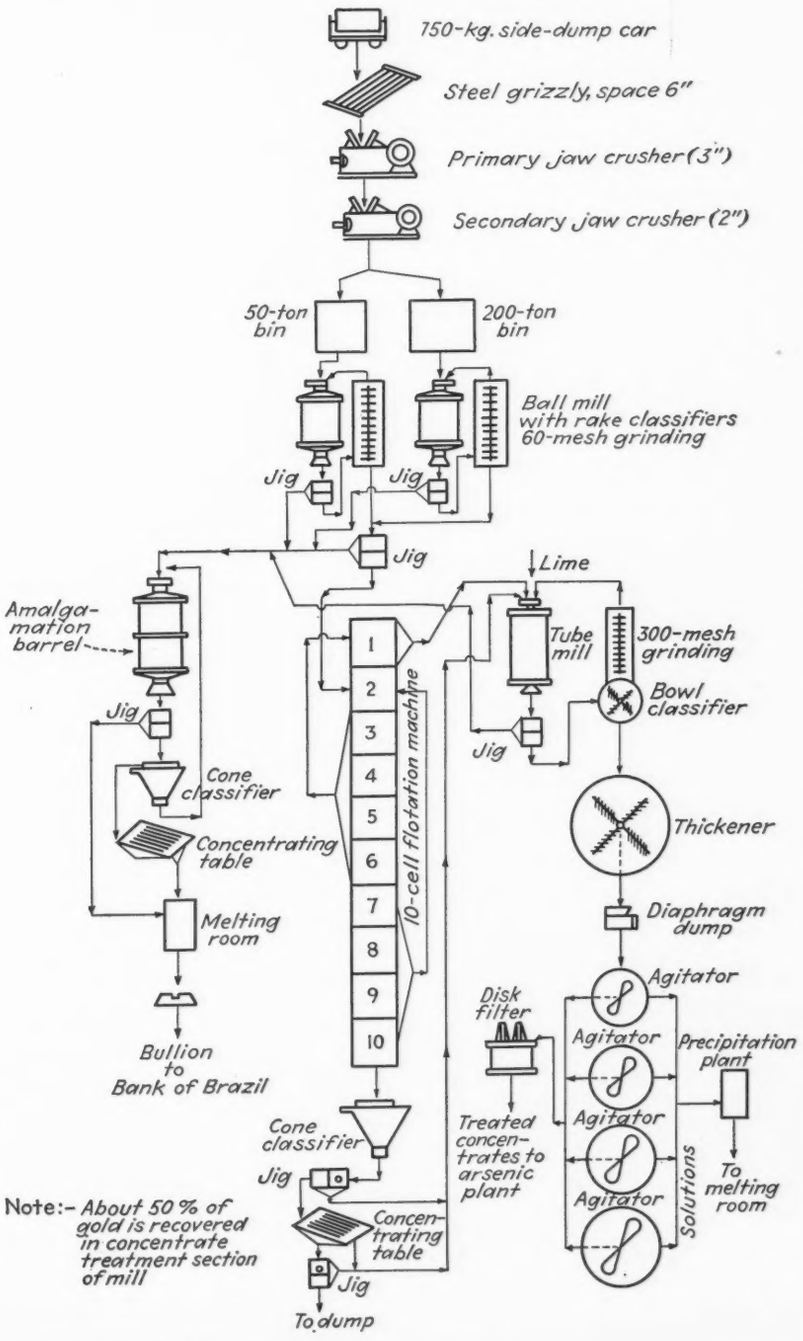
Dr. Pinto took me through the various laboratories, and explained some of the experiments in progress. Layout and equipment are the best, but not enough hands to handle the machinery are available. All are very enthusiastic about their work. Minerals under investigation include chromite, manganese, and phosphate; in a word, ores of the strategic class. I had some frank talks with the different department heads about mining in Brazil, and all answered willingly. Though information on iron, manganese, and coal deposits is relatively easy to obtain, it is difficult to get facts and tonnages on such minerals as beryllium, tungsten, mica, sulphur, and others. In some cases deposits are known and worked, but often the information is based on the fact that specimens of the particular minerals have been brought from certain regions or States. In many cases long search is necessary.

When looking upon the problems confronting the Mining Bureau one should keep in mind one fact—namely, that until recently the mining industry in Brazil has stagnated, while the agricultural and manufacturing industries have rapidly increased in wealth and importance. In many States mineral deposits are entirely undeveloped and their extent is unknown. A great task of mapping, drilling, and testing, not forgetting prospecting, faces the heads of the Bureau of Mines. Participation of foreign capital in the development of natural resources seems hopeless under the present mining law and the spirit of nationalism.

As luck would have it, I ran into Dr. Emilio Teixeira while leaving the Bureau of Mines building. He is now stationed in Bello Horizonte, where he promised to meet me Saturday morning. He told me how happy he was that his life's dream—the new $45,000,000 steel plant between Rio and São Paulo—was coming true at last, an undertaking that will hasten Brazil's industrialization. Boom conditions prevail at the construction site as well as at the Catarina coal mines which will supply part of the fuel for the blast and steel furnaces. The latter regions are in for quite a few changes, for, to meet the demands of the new steel works, hand methods now employed at the coal mines must give way to mechanization, and it will be here that the manufacturer of mining machinery will find his first market. Catarina coal will coke after careful washing, Dr. Teixeira said, but the resultant coke must be mixed with foreign coke to be of maximum effect in the blast furnace. The ratio will be 1 to 1. To bring about efficient and cheap washing of mined coal will mean installation of modern washing plants. Upon completion of the steel plant Brazil's dependence on foreign steel will be at an end, according to Dr. Teixeira. Not so, however, in the matter of special steels.

Though everything is done on the part of the Government to push mining, it remains a hard and slow road uphill. This I gathered from subsequent conversations with local business men. Defective mining laws, nationalism, inexperienced engineers and labor, and limited capital for systematic prospecting and development of mineralized areas, inefficient railroads, and lack of roads to more remote regions are the crux of the situation. The picture becomes more clear to me from day to day. Brazil is in the same situation the United States was in 60 years ago. The center of population is in regions along the coast, and vast and unexplored areas are to the West. There is only one difference—namely, in the United States practical development of the frontier regions came before polities and nationalism; hence unprecedented development of natural resources and creation of wealth. It is a tragedy that the present good-neighbor policy could not have been instituted when the

Flowsheet of 150-ton Juca Vieira flotation-cyanidation plant of Cia. Brasileira de Mineiracao, S. A., near Caete, Minas Geraes



Sao Bento gold mine of South America Gold Areas Co., at Santa Barbara, Minas Geraes

Monroe Doctrine was declared. It was then that the Latin American countries needed our help and advice most; but, alas, we were too busy developing our own frontier areas.

When I requested my passport from Panair, before going to Bello Horizonte, I was told that inasmuch as my stay in Rio would be but for eight days I must register at the police station, pay 200 milreis for stamps, and 500 milreis tax, or a total of $35, in view of the fact that my departure for Buenos Aires was scheduled for Jan. 5. However, I finally settled for 100 milreis, or $5.

Going to Bello Horizonte as arranged, I spent a week in the iron, manganese, pyrite, and gold belt in this area, which is in the State of Minas Geraes. I made the trip from Rio by plane, which is the best, quickest, and safest mode of travel. Flying time is about 1 hour 20 minutes and distance from Rio some 210 miles. One can also go by car or train, the trip taking anywhere from 10 to 16 hours. Train service is not the best, and one had better forget train schedules, for "trains on time" are a rarity. The reason? Accidents! We had four during one trip—from hot boxes to derailments. As this happens almost every day, people are so used to it that they are well prepared for a long trip, no matter how short the distance.

Before I proceed I want to say that I saw more of mining operations in one short week than the average visitor would in one month, thanks to excellent planning and help on the part of Dr. Teixeira, who is mining engineer and geologist of the Department of Mineral Production. I owe him much. He is capable, hard working, and dependable. Another gentleman to whom I owe thanks is Dr. Sylvio Barbosa, of the Escola de Minas at Ouro Preto.

All trips to the different properties were made by car or rail through country that reminded me of the foothills of the Sierra Nevada on the California side. The same topography, altitudes, and even climate. The people were friendly everywhere, and the attentions and courtesies shown me were almost embarrassing at times. Save at Morro Velho, all the people that I met were Brazilian. The managers of the different mines visited showed me all I wanted to see and answered all questions frankly. I was pleased to note the efficiency with which some of the mines were run. Of all the impressions gained, three stand out above all others:

1. The mineral wealth in Minas Geraes is real, and not fictitious. Development and production are limited by transportation alone. Increased output, if demanded, will mean modernizing the present railroad system, which is a big job for a big man. It will mean laying down heavier rails, and more powerful haulage units, and cars, and more cars. The fuel question plays a big rôle. Both coal and wood are used for firing and locomotives. As most lines follow rivers at the bottom of endless canyons and valleys, electrification of the network of the Central R.R. lines is not only feasible but practicable. There are numerous hydroelectric plant sites which could serve as feeder stations. Money is the only stumbling block. As to mineral deposits, I saw and walked over such vast stretches of high-grade iron ore that I actually dream iron.

2. Brazilian employers have outdone their colleagues in the United States in matters of social improvements and employer-worker relations. Some of the model towns I saw in different camps put to shame the unsatisfactory housing conditions in some of our well-known mining areas in the West. In addition to model houses there are workers' clubs, kindergartens, free medical and hospital facilities, and pension systems. Every village, no matter how small, has a soccer football field. As to present labor laws, employers find them "irksome" at times, but most attribute their resentment more to unwillingness to make changes than to actual dislike for the new measures.

3. The will to manufacture goods and machinery in Brazil. At the Fair in Bello Horizonte I saw well-made farm machinery, textiles, chemical wares, etc.—yes, even show cases and soda fountains cooled by refrigeration. I hardly believed my eyes when I saw locally made ball mills, jigs, classifiers, and others. Some of the units were well designed and of sturdy construction. At the foundry at the Juca Vieira mine, near Caete, I saw them turn out mill liners, crusher plates, and the like, of good quality. I asked one prominent Brazilian how far they intend to go in this matter. He answered "The whole way." Brazil seeks a well-balanced economy composed of both industry and agriculture to be as little dependent on imports as possible. Nationalism, pure and simple.

On Sunday morning, Dec. 28, Dr. Teixeira and I motored to Caete to see the Juca Vieira gold mine of Cia. Brasileira de Mineiração and managed by Djalma Guimaras, one of Brazil's foremost geologists. He was formerly connected with the Federal Geological Survey. This is a purely Brazilian enterprise—owned, operated, and managed. It is a low-grade mine; heads average 5 grams per ton, and recovery and costs compare well with those obtained in the United States. Mill and power-generating equipment are entirely German, and the drills used underground are of Demag, Holman, and I-R make. Juca Vieira is a relatively old mine, the first work being done more than 100 years ago. Between 1891 and 1893, a small Brazilian company rehabilitated and worked the property with a stamp mill. As only the free gold could be extracted, recovery was low. Succeeding attempts to put the mine on a paying basis failed, and it was not until 1932, when the Federal Mining Department investigated the underground workings and subsequently proved continuation of the ore in depth, that private capital was attracted. The Cia. Brasileira de Mineiração reopened the mine in 1936, and has operated ever since.

As mentioned previously, the mine is near the town of Caete, about 53 km. from Bello Horizonte. Supplies can be brought in by truck or on the Central do Brasil R.R. As to local geology, the chief rock formation in the area containing the Juca Vieira mine is a dolomitic phyllite interbedded by graphitic and carbonaceous schists. The material is hard and well laminated when fresh, and has a greenish color. When decomposed it turns into a red soil, usually extending to considerable depth. The orebody proper, of the *echelon* or "step type," occurs in the dolomitic phyllite, with well-defined walls. Faults and folds are common. The vein has been traced from Mina Velha to Paulina, a distance of some 900 m. It varies in thickness up to 14 m. The ore is complex, and resembles closely that mined at Morro Velho by St. John del Rey Mining Co. Arsenopyrite, pyrrhotite, and pyrite are the main sulphide minerals, with small amounts of stibnite, galena, and sphalerite. The free gold present in the vein is coarse. The arsenopyrite is the

chief gold-bearing sulphide mineral.

Current mine production is 150 tons. Development consists of two incline shafts, with a third shaft being sunk from an adit completed recently a short distance from shaft No. 1, the main haulage shaft. All are sunk at an angle of about 35 deg. and depths of shafts Nos. 1 and 2 are 206 m. and 120 m. respectively. There are three working levels in the old section of the mine and one level in the new. As the ground stands up well, ore is mined by open-stope methods. Drilling is done with air drills, using hexagonal steel with forged-on bits. Tramming is done manually. Mined ore is loaded into 750-kg. side-dump cars and hauled through the incline shaft to the crusher floor, where it is dumped over a steel grizzly spaced 6 in. Oversize is reduced by hand, and the undersize is fed to a jaw crusher set to give a 3-in. product. This is reduced to 2 in. in a second jaw crusher before being conveyed to two storage bins, one holding 50 tons and the other 200 tons. Grinding to 60 mesh is done in two ball mills operating in closed circuit with rake-type classifiers. Jig units are installed between the ball mills and classifiers to remove liberated gold particles from the circuit. Overflow from both classifiers, after passing over a jig, goes to cell No. 2 of a ten-cell flotation machine. The product of cells 3, 4, 5, and 6 goes to cell 1, which produces finished concentrates, and that from cells 7, 8, 9 and 10 returns to cell 2 as shown in the accompanying flowsheet. Finished concentrates are ground to 300 mesh in a tube mill operating in closed circuit with a bowl classifier. Here, too, the overflow from the ball mill is first treated in a jig before entering the classifier. Grinding is done in lime water to reduce acidity, and particles worn off the chilled iron liners are recovered by the jig unit. Mr. Guimaras attributed the low cyanide consumption, which is around 130 grams per ton, to these two factors.

Overflow from the bowl classifier goes to a thickener, whence the thickened pulp is pumped by a diaphragm pump to the cyanide department containing three agitators with a capacity of 6 tons each, and one of 9 tons. Here, batch cyaniding is practiced. Loaded agitators are treated in three 12-hour periods, or a total of 36 hours. Resultant solutions are pumped to the precipitation plant, and treated concentrates are sent to the arsenic recovery plant after dewatering in a two-leaf disk filter. Tailings from the flotation machine are directed successively to a cone classifier, jig (pulsator), concentrating table, jig (pulsator), and tailings dump. Concentrates produced by these two jigs are returned to the head of the tube mill, which also receives the concentrates from the pilot table. Those produced by the other jigs are treated in an amalgamating barrel. The overflow from this unit, after passing over a jig, goes to a cone classifier, from which the underflow returns to the amalgamating barrel and the overflow to a concentrating table. Concentrates produced by the table and jig concentrates go direct to the melting room; table tailings flow to the thickener.

Reagents used are pine oil, Aerofloat, xanthate, sodium silicate, and sodium sulphide. These are added at cell 2, and Aerofloat and xanthate at cell 7. Consumption per ton is as follows: Pine oil, 40 drops per minute (as I do not know weight, surface density, etc., I cannot calculate grams. Mill superintendent gives drops only in reports); Aeroflat, 6 drops per minute; xanthate, 50 gr.; sodium silicate, 250 gr.; and sodium sulphide, 100 grams. Lime consumption for every six-ton batch of concentrates ground is 150 kg. The ball mills are charged with 3-in. and 4-in. balls, with consumption amounting to about 1 kg. per ton. Some 13 m.^{3} of pregnant solution are treated a day at the precipitation plant, using 2 kg. of zinc dust. Total recovery is 97.4 percent. Operating costs are $3.75 per ton.

Men employed at the mine number 120, at the mill, 28, and on general surface work, 66. Wages range from 45c. to 75c. per 8-hour shift. Electric power produced at the power house totals 910 hp., of which 120 hp. is furnished by a small water turbine. The other generating units are driven by producer gas, and oil. There are also well-equipped repair shops, and a small foundry is available. We inspected the mine and mill in company of Raul de Teixeira da Costa, superintendent in charge of operations. He is an enthusiastic worker, and the many courtesies shown me were very much appreciated.

On the return trip to Bello Horizonte we took a quick look at the two blast furnaces (50 and 70 tons), steel plant, and rolling mills of the Cia. Siderurgica Belgo-Mineira at Sabara. Most of the officials were Luxemburgers. About 45 km. from Bello Horizonte, at Feixo do Funil, Minas de Ferro, S.A., is increasing production of iron ore from about 200 tons to a possible 1,000 tons a day, with new transportation and loading facilities in course of construction. Here I had a lengthy chat with Antonio Antunes, general manager. We arrived in Bello Horizonte about 3 p.m., in time to catch the train for Ouro Preto.

(To be continued)

Steel works of Cia. Siderurgica Belgo-Mineira, at Monlevade, Minas Geraes

At the Campo de Sacco bauxite mine of Cia. Geral de Minas, at Poco de Caldas. Minas Geraes

The Design of Underground Turnouts

Deflection methods for locating the center lines are simpler, more accurate and easier to handle

Nels P. Peterson
Associate Professor of Mining
New Mexico School of Mines
Socorro, N. M.

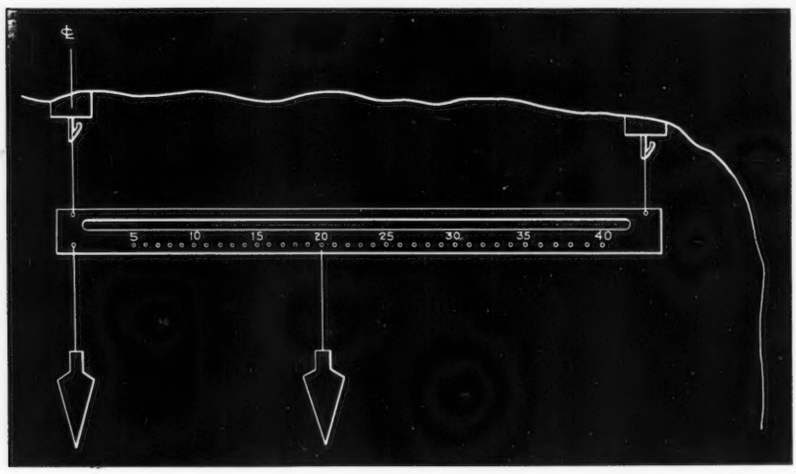


Fig. 1—Curve projector devised by author for obtaining deflection angles without transit

PROPER ALIGNMENT of curved drifts and crosscuts and the design of turnouts are important factors in the efficiency of modern underground haulage systems. Delays and lost time due to derailments of cars and locomotives may be materially reduced if all turnout curves are actually segments of circular arcs, and if frogs and switches are designed and installed to conform as nearly as possible with the turnout curve. The cost of a properly designed turnout, like that of any other well-engineered project, will probably be less than the cost of one laid out by guess or trial. The routine, as well as the design, can be standardized so that no time is lost while the trackman is "figuring the thing out."

Location of curved center lines for the alignment of underground drifts and crosscuts differs from that of curves laid out on the surface in that every point on the curve is inaccessible until after the heading has been advanced beyond that point. For this reason underground curves require an entirely different technique.

Numerous methods have been proposed, and some have been described in the technical literature. Some methods employ offsets from tangents or from chords[1] or from chords produced[2]. Others make use of deflection angles employing several variations in the methods of measuring and laying out chords. The variety of methods is probably due to the lack of opportunity for most engineers to gain sufficient experience in this field to perfect and standardize the procedure.

I have at various times tried out most of the proposed methods and have devised others. Thus, I have had ample opportunity to discover the advantages and disadvantages of the various methods.

Offset methods proved to be rather impractical and inaccurate, especially if the alignment of development headings must be entrusted partly to workmen or mine bosses. Deflection methods are simpler and more accurate and are more easily handled by workmen unversed in the theory of curves.

Unquestionably the most satisfactory control is obtained when the engineer can visit the face before each round is drilled and mark or paint the center lines on the face, one line marking the true center of the present face and one showing the offset to the bottom of the following round.

The alignment procedure consists in measuring the distance from the point of curve to the center of the face and computing the deflection angle for the length of chord equal to the measured distance. The transit is then set up under the spad marking the point of curve, the backsight is taken on the tangent, and the computed deflection angle turned off. The point at which the line of sight intersects the face will be the true center of that face. The average length of round broken can then be added to the measured chord, and the corresponding deflection angle computed. The point at which this deflection intersects the face will show

[1] Clayberg, G. A.: "Survey Lines for Drift Curves." *E. & M. J.*, Vol. 131, p. 221, March 9, 1931.

[2] Bockman, K. L.: "Direction Lines for Drift Curves." *E. & M. J.*, Vol. 132, p. 203, Sept. 14, 1931.

approximately the amount of offset required in the following round.

When the center of the face is no longer visible from the point of curve, a point on curve is established nearer the face. From the new point the procedure is exactly the same, except, of course, that of getting on tangent.

Considerable time can be saved by preparing a table showing the deflection angles for various lengths of chord measured from the P. C. or intermediate transit points on the curve. For convenience, deflection angles can be computed for each foot of increase in the length of the chord from about 5 ft. to the chord length at which the line of sight is cut off by the side wall of the heading. The maximum chord and deflection which can be measured from a given point will, of course, depend on the width of the heading and the degree of curvature.

$$\text{Sine of deflection angle} = \frac{\frac{1}{2}\ \text{chord}}{\text{radius}}$$

When the working schedule is such that it is impracticable or impossible for the engineer to visit the face between each round, a method must be devised by which the workmen can measure the chord and obtain the center line whenever required. The procedure must be simple and reasonably foolproof.

Probably the best method of obtaining the deflection angles without the aid of a transit is by means of a properly designed curve projector mounted 5 or 6 ft. behind the P. C. or intermediate points on curve. Such a curve projector has been recently described in detail by Farmin, Waterman, and James[3].

The projector which I employed is illustrated in Fig. 1. It differs only in minor construction details from that described by Farmin, Waterman, and James. It consists of a strip of light galvanized iron turned over on one edge or slightly deformed to give the necessary stiffness. Along the bottom edge is a series of $\frac{1}{16}$-in. holes spaced to give the proper deflection angles for the chord length stamped over each hole when the deflector is hung a specified distance from the P.C. of the curve. Near each end of the top edge are holes for hanging the strip from spads located in the back of the working. One hole is directly over the zero deflection hole so that one supporting spad can be placed on the tangent a convenient distance, usually 5 or 6 ft., behind the P.C. spad. The other supporting spad is located so that the projector strip will hang at right angles to the tangent.

The alignment procedure consists in measuring the distance from the P.C. or P.O.C. to the face, then marking the center-line by sighting two plumb bobs, one hung from the P.C., the other from the hole in the projector strip corresponding to the measured chord.

This is probably the most foolproof and accurate method of curve control for manipulation by miners. If the center line is checked occasionally by the engineer there is little danger of serious deviations due to errors or slight misalignment of the projector strip.

An important advantage of the projector strip over the commonly used substitute of a series of spads driven in a stull placed across the back of the drift is that the strip can be taken down and stored in a safe place when blasting.

In some mines the haulageways require complete support by means of timber sets, as for example on the haulage levels of the Nevada Consolidated Copper Corp. mine at Ray, Ariz.

A typical standard 60-ft.-radius timbered turnout used in the Ray mines is illustrated in Fig. 2. The first section of the turnout curve requires no special control other than the installation of the standard timber turnout sets prefabricated with progressively longer caps up to the point at which there is complete separation of the two branches. The two longest caps consist of heavy steel I-beams. From this point the turnout is timbered with standard drift sets placed radially at 5-ft. intervals measured on the curved center line.

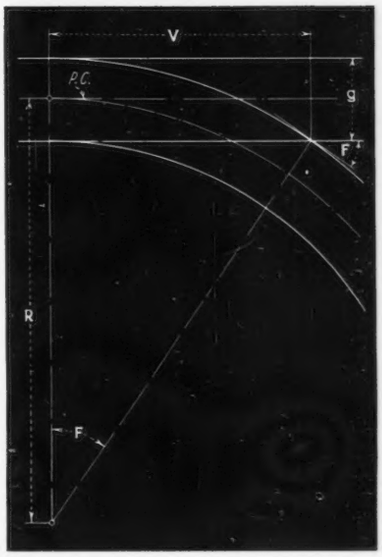


Fig. 3

The first radial set is a swing set which is an integral part of the turnout assembly. To establish a control for locating the succeeding sets the transit is set up under the P.C. of the curve and a P.O.C. is established in the cap of the swing set. From this P.O.C. guide spads are set so as to mark the deflection angles to the centers of each succeeding set—that is, for each 5-ft. chord, up to the point at which the line of sight is cut off by the posts. The guide spads are conveniently placed in the collar braces of the main fringe timber. If necessary a second P.O.C. is established with enough guide spads to complete the curve.

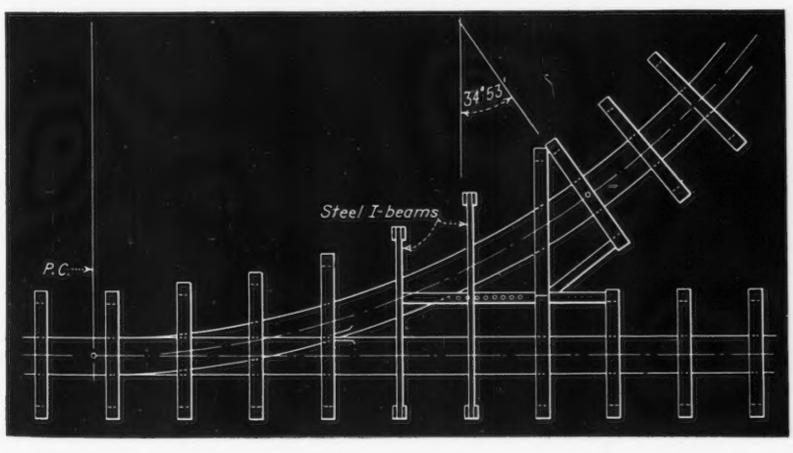
If the center line of the turnout drift or crosscut is a true circular arc, the center line of the switch and curved track should be designed to coincide as nearly as possible to the same arc. By using specially designed frogs and curved switch points it can be made to coincide exactly, but this is usually considered an impractical refinement. An equally satisfactory installation can be obtained using standard frogs and switch points provided the frog is properly chosen and located correctly.

The Standardization Division of the American Mining Congress has done an excellent piece of work in setting up standards for light-rail track equipment, and the manufacturers have not been slow in adopting them. A few manufacturers are still listing special frogs and points not included in the Congress standards, probably because certain consumers insist on calling for them. The standard equipment can usually be made to fill all requirements except perhaps for very short-radius turnouts.

Complete data covering standard-

[3] Rollin Farmin, G. C. Waterman, and Allan James: "Survey Control of Curved Crosscuts." *E. & M. J.*, Vol. 138, p. 194, April, 1937.

Fig. 2—Typical standard 60-ft.-radius timbered turnouts used in Ray mines



gage turnouts can be found in all railroad handbooks; but because of the wide range of track gages and small-radius curves prevalent in metal-mine haulage systems, complete data on all combinations of gage and radius are not always available. Therefore the mining engineer must be able to make all computations pertaining to the design of turnouts.

The first step is the selection of the frog suitable for a turnout having a given radius and track gage. The true frog angle may be obtained by the formula:

$$\text{Cos } F = \frac{R - \frac{1}{2}g}{R + \frac{1}{2}g}$$

in which F is the true frog angle, R the radius of the curved crosscut, and g the track gage.

We can now refer to the drawings of standard frogs prepared by the Mining Congress or manufacturer's catalogs and select the standard frog having a frog angle nearest the computed true angle. The error in angle introduced by selecting the nearest standard frog will not be noticeable. Another method is to compute the true frog number (N) from the relation:

$$N = \frac{0.5}{\tan \frac{1}{2}F}$$

We would then select the standard frog with number nearest that of the computed value.

The position of theoretical point of frog with respect to the P.C. of the curve is the distance V in Fig. 3.

$$V = (R + \tfrac{1}{2}g) \sin F$$

in which F is still the true angle of frog.

The distance from the P.C. to the actual point of frog will then be $V + \frac{NB}{12}$, where N is the actual frog number and B is the thickness of the frog point in inches. If we add to this distance the actual heel length of the frog selected, the engineer can locate and mark the point on the rail of the tangent track where it should be cut for the installation of the frog. If this procedure is followed the frog will be located in the correct position so that the center line of the track coincides with the center line of the curved crosscut. If the proper frog has been selected the turnout will conform as closely as is necessary to the true curve of the crosscut.

The point of switch will not usually fall exactly at the P.C. of the curve if standard straight switch points are used. The length of the switch points used with a given frog should comply with the recommendations of the Mining Congress' Committee on Standards, which are as follows:

3 ft. 6 in. switch points for use with No. 2 frog.
5 ft. 0 in. switch points for use with Nos. 3 and 4 frogs.
7 ft. 6 in. switch points for use with Nos. 5 and 6 frogs.

Having selected the proper frog and switch points the lengths of the straight and curved closure rails can be computed.

In Fig. 4 the length of the straight closure rail is equal to the theoretical lead (X) minus the length of the switch point (L) minus the distance from the theoretical point of frog to its toe (E).

Length of straight closure rail $= X - L - E$

Theoretical lead $(X) = L \cos S + M + E \cos F$

F is here the actual frog angle of the frog to be used.

$$M = \frac{g - H - E \sin F}{\tan \frac{1}{2}(F + S)}$$

in which F is the actual frog angle, H the heel spread of the switch points, and S the switch angle, that is, the angle formed when the beveled side of the switch point lies against the straight rail. E is the distance from the theoretical point of frog to its toe. Care must be observed in the consistent use of units—that is, the computation must be carried out either in feet or in inches.

The radius of the turnout will not ordinarily be exactly the same as the radius of the curved crosscut because of the short tangents introduced by the frog and switch point. Therefore the radius of the curved closure rail will not be equal to $R + \frac{1}{2}g$.

The radius (R') of the curved closure rail will be the radius of a curve tangent to the frog and to the switch point when lying against the outside rail in the position for diverting the train onto the turnout.

$$R' = \frac{M}{2 \cos \frac{1}{2}(F + S) \sin \frac{1}{2}(F - S)}$$

The interior angle of the curve is the difference between the frog angle and the switch angle.

$$F - S$$

The length of the curved closure rail is equal to the product of the radius of that rail and $F - S$ expressed in radians.

Length of curved closure rail $= R'(F - S)\ 0.01745$

If cast frogs are to be used, the lengths of the closure rails must be increased by the amount of overlap of the rail on the frog casting, which is ordinarily 10 in.

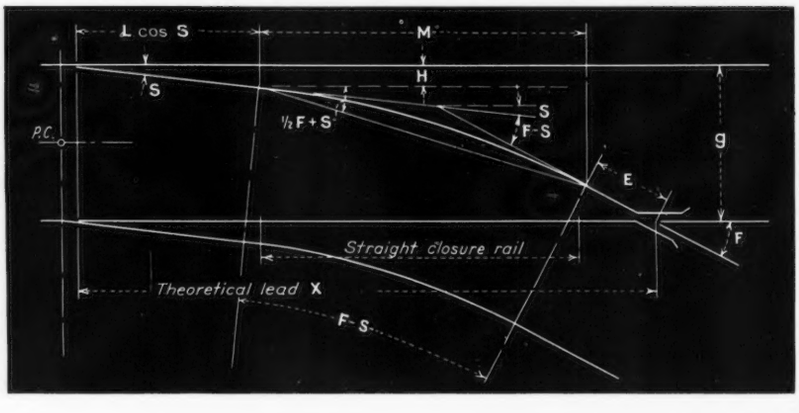
The curved rail can be easily and accurately shaped by using the middle ordinate as a guide.

$$M.O. = R' - R' \cos \tfrac{1}{2}(F - S)$$

The installation can be greatly facilitated by preparing a working drawing showing the lengths and spacing of the switch ties. The spacing dimensions should be tied to the P.C., inasmuch as this point is usually a station in the back of the drift and always accessible as a reference point by suspending a plumb bob from the spad. Thus the special ties may be cut and numbered in the surface framing shed, then brought underground and properly spaced before the rails are assembled. If the actual point of frog has been located from the P.C., all other switch parts will be in the correct position when the assembly is complete.

Only one step remains, that of locating the point at which the continuous inside rail is slightly bent where it takes off from the tangent. This point will be ahead of the end of the switch point a distance equal to the thickness of the switch point divided by the tangent of the switch angle (S). The deflection of the rail will, of course, be equal to the switch angle.

Fig. 4

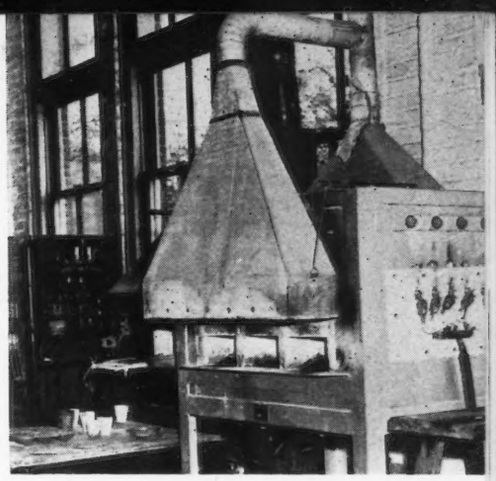


A New Electric Reverberatory Roasting Furnace

Gives rapid desulphurization, reveals no defects

Metallurgy Department

Missouri School of Mines and Metallurgy
Rolla, Mo.



A view of the furnace. The three compartments for ore are seen, also the ends of the heating rods and the manner of disposing of gas

AT ROLLA, MO., a new electric reverberatory roasting furnace which desulphurizes very rapidly and is suitable for laboratory testing has been designed by the Metallurgy Department of the Missouri School of Mines and Metallurgy. Its features of construction are shown in the adjacent drawing and photograph. The unit seen in the latter was built by the Harper Furnace Co., Niagara Falls, N. Y. It is said to have been in service for over three years, in which period no defects have developed.

This furnace is heated by five ¾-in. Globar rods, 4 ft. long, suspended by the end walls 9½ in. above the hearth. It is insulated by Armstrong brick.

There are three roasting compartments separated at the base by firebrick placed on edge. The roasting gases flow upward, pass the Globar rods to the 3x3-in. vents and thence go to the stack.

The accompanying voltage-current temperature chart shows the rate of heating and cooling of the furnace.

Because of sweeping currents of pure air passing over the sulphide concentrate, desulphurization is very rapid. The quality of the calcine for leaching is high because there is no part of the furnace in contact with the concentrate that has a higher temperature than that of the ore itself.

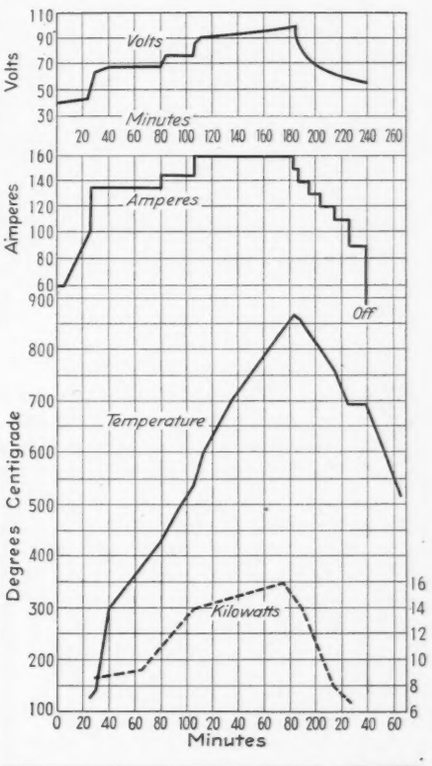
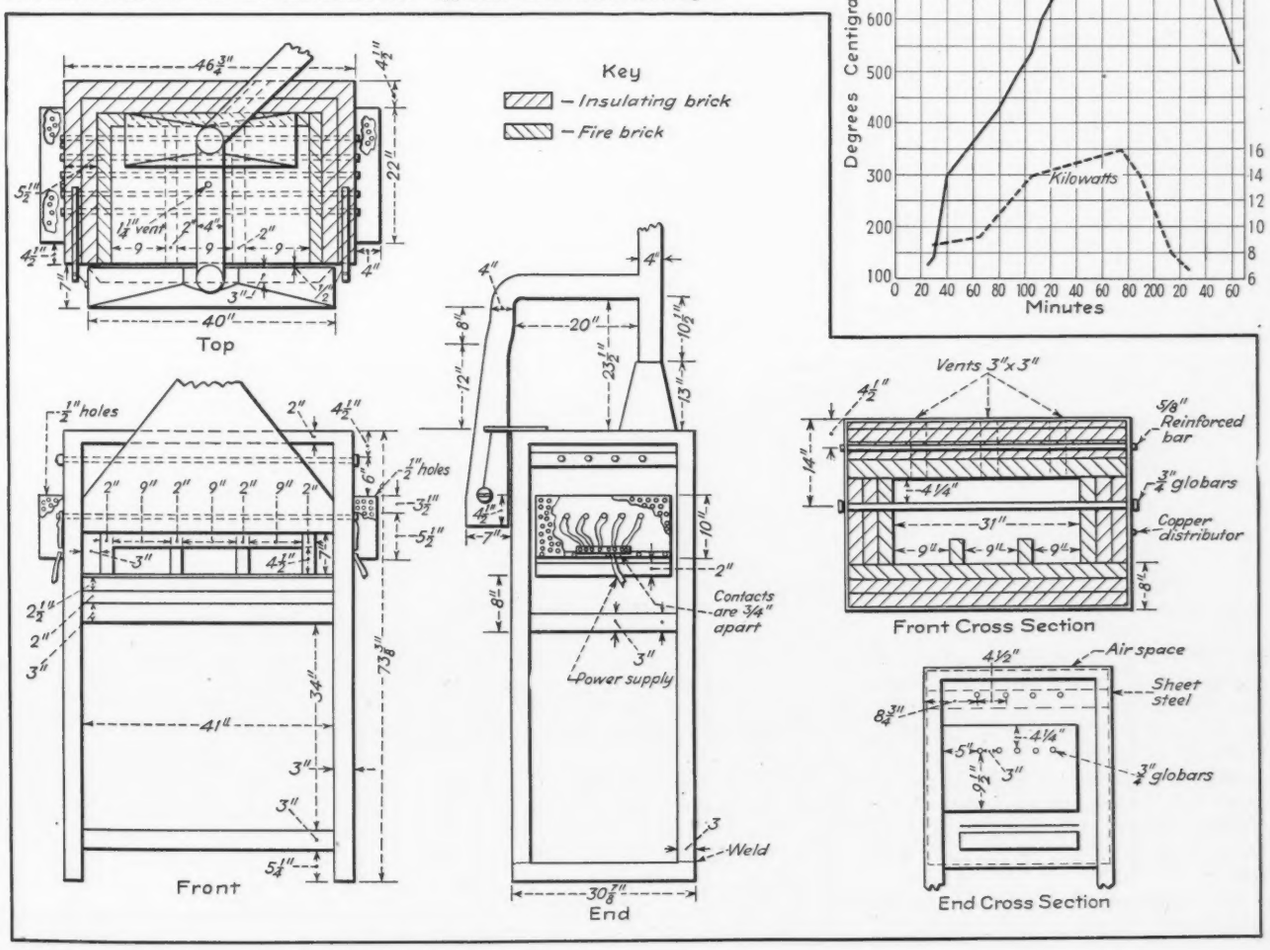
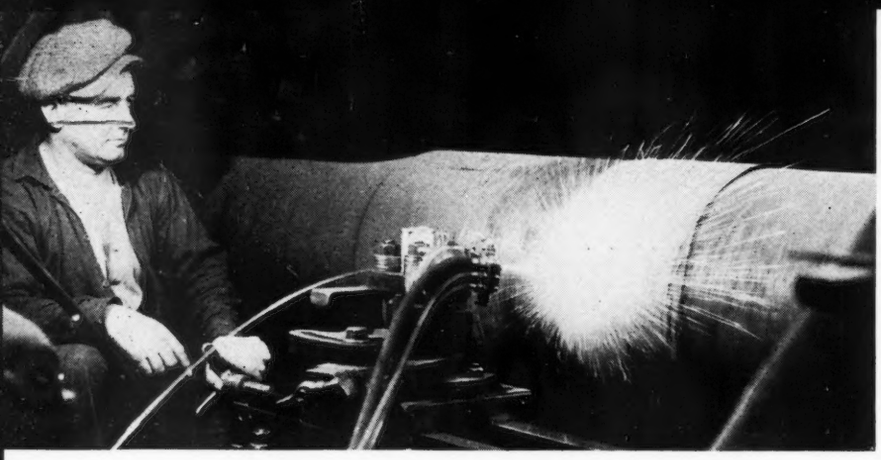


Chart showing the heating and cooling of the furnace

Construction details with the dimensions are apparent from these drawings





Metallizing the drum shaft of the Copper Range Co.'s hoist

Economy in Maintenance by Metallizing

Substantial savings in repairing drum shaft of hoist

William H. Schacht
President Copper Range Co.
Painesdale, Mich.

SOME TIME AGO it was discovered that the drum was creeping on the shaft of the 32x72-in. Nordberg steamhoist at the Copper Range Co.'s No. 3 shaft. This drum is conical in shape, 12 ft. in diameter at the small end and 18 ft. at the large end, 17 ft. 10 in. in length over all. The weight is approximately 65 tons. The drum shaft is 17¼ in. in diameter, 27½ ft. long, and weighs about 18 tons. About a year ago, when the creeping was first noticed, the shrink links holding the drum spiders to the shaft were moved and an inspection was made, revealing that the key was distorted and that there had been wear on the shaft and spider fits on the ends nearest the journal boxes, this after 30 years' operation of this engine. As a temporary repair, shims were placed between the spider and the shaft, new keys fitted, and the spiders drawn together with new shrink links. Finally, the condition became so bad it was necessary to close down to make a permanent repair.

Various ideas were considered, but each, it appeared, would involve great expense and an indefinite shutdown. For example, it would have been necessary to tear out the side of the brick building to remove the shaft. We needed some means of building up the shaft to fit the rebored hubs of the spiders, and the job would have to be done in place under the engine's own power.

We explained the situation to the Metallizing Company of America at Chicago, and the company dispatched an operator and metal spraying equipment to the property within 48 hours.

In the meantime, the drum was blocked up with timbers, the brake drums and spiders were removed so that the shaft could turn freely inside the drum, and the spiders were shipped to a nearby machine shop where the damaged hubs could be bored over-size. Instructions were given to bore them to the minimum size at which they would clean up.

On inspection it was decided it would be necessary to machine the shaft to true it up and rough it before spraying and again after spraying to fit the rebored spiders. (Where only 0.020 to 0.030 in. of metal is needed for a press or shrink fit, it is possible to grit-blast the shaft and spray to size without turning or grinding.)

A framework of I-beams was erected beneath the damaged portions of the shaft and on this was mounted a portable lathe bed. With the drum removed from the shaft there was a great deal of "hop" when turning under steam power. This was greatly reduced by fastening several tons of weights to one side of the shaft with clamps to counterbalance the crank arms. This reduced the hop to a point where at 15 r.p.m. the ratio of speed between the fast and slow sides of the shaft was 2 to 1. This would make practically no difference in the machining of the shaft, but, as pointed out later, it would affect the application of metal to the surface.

The first step then was to turn the shaft undersize sufficiently to true it up. There were four sections, each about 10 in. long, two at each end of the drum. Shaft diameter was 17¼ in. It was necessary to undercut, so a special tool was prepared and a "rough thread" was cut. Due to the heavy build-up necessary, a coarse thread was used, about 16 to the inch. Its purpose was to give anchorage to the sprayed metal. A block of hard wood was fitted into the keyway and the first section was ready for spraying Sunday noon.

Not knowing to what size the spiders would be finished, the shaft was sprayed to finish at 17½ in. This meant a deposit in excess of ¼ in. on a side, and here is where the "hop" mentioned above became interesting. As the metallizing gun would deposit in proportion to the speed of the surface passing the nozzle, the slow side of the shaft would receive twice as much metal as the fast side. This meant it would be necessary to deposit better than ½ in. of metal on one side of the shaft to get ¼ in. on the other. This would also tend to give an uneven distribution of heat.

To guard against mishaps the gun was kept a good 7 in. from the shaft and its speed was controlled to deposit not over 4 lb. of 0.25 carbon steel per hour. Under these conditions the shaft at no time reached a temperature of 125 deg. F. at either edge of the sprayed surface.

The first section was finished shortly after midnight and preparation was immediately started on the adjoining section. This was prepared and sprayed in the same manner, and at 2 a.m. Tuesday one-half the job was sprayed. A crew was waiting to rig up the lathe at the opposite end of the drum, and by 7 a.m. the third section was being prepared. This was completed shortly after midnight, and Wednesday morning by 8 o'clock the machinists were preparing the fourth and last section. The operator finished spraying it at midnight Wednesday and the machine crew immediately started rough-machining the sprayed surface of the shaft.

These surfaces were elliptical in shape, and it was necessary to remove a quarter-inch of metal from the high side before the tool began to touch the low side. Despite this and the fact that there was a 3-in. keyway, no tendency developed for the sprayed metal to chip or peel.

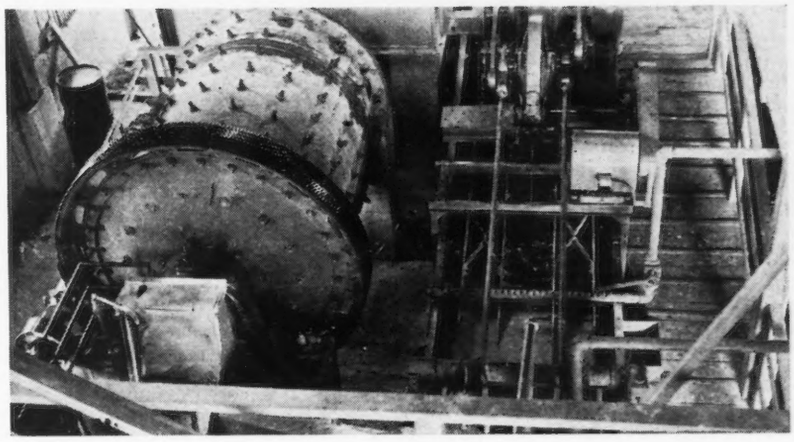
As soon as we received the finished size of the spider bores, the shaft was finish-turned 0.015 in. oversize. These fits were originally made "iron to iron," but at the recommendation of the Nordberg engineers the shaft was finished 0.015 in. over the size of the spider bore.

The actual spraying time was 52 hours. Approximately 200 lb. of metal, 2,300 cu.ft. of oxygen, and 1,839 cu.ft. of acetylene were used. The total cost of this work amounted to only a small fraction of the cost of a new shaft and drum, and the time required was much less than what would have been required for installing a new shaft and drum.

At the Cochenour Willans Mill

Amalgamation, cyanidation, and flotation mark flowsheet. Aeration of mill water drawn from ice-covered lake improves recovery of gold from tailings

Owen Mathews
Mill Superintendent
Cochenour Willans Gold Mines, Ltd.
Dome, Ont.



Ball mill, unit jig, and classifier used in the grinding circuit

MINE AND MILL of Cochenour Willans Gold Mines, Ltd., are in Dome Township, in the Red Lake area of northwestern Ontario, about 100 miles north of Kenora on the Canadian Pacific. Communication with the railway throughout the year is by commercial airlines. The mill was designed and built by Shoemaker and Burnham, of Toronto, and is now handling 165 tons a day.

The ore is inclined to be refractory and about 60 percent consists of silicified rhyolite, the remainder being a complex of cherty quartz, cherty quartz-carbonate, and carbonate carrying free gold. Minor gangue minerals include calcite, ankerite, chlorite, sericite, and apatite. The sulphides comprise about 2 percent of mill tonnage and are mostly pyrite, arsenopyrite, pyrrhotite, sphalerite, and stibnite, with minor quantities of chalcopyrite and tetrahedrite. The country rock is a series of highly altered Keewatin lava flows with some sericite, quartz, and carbonates. The sericite is objectionable because it slimes readily and settles slowly in the thickeners.

Treatment of the ore is difficult because the gold in the sulphides is very fine and locked up in the sulphides. Free gold in the gangue has an average diameter of about 11 microns, whereas the gold in the arsenopyrite averages 8 microns, with some as fine as 3 microns.

The mill circuit involves amalgamation, cyanidation, and flotation of the cyanide tails. Until the autumn of 1940 flotation concentrates were shipped to Tacoma, Wash., for smelting. That winter, ice conditions on the lakes were unfavorable for tractor trains, so shipment was discontinued while awaiting water transportation after the break-up. In the meantime, concentrates were stockpiled. As the cost of shipping and treatment is high, the possibilities of local smelting are being considered.

Milling commenced Nov. 29, 1939, using amalgamation and cyanidation only until May, 1940, when a flotation unit was installed to treat the cyanide tails, which were high in value. Flotation recovery improved steadily until September, 1940, the best month as regards tailings and extraction. As winter came and ice covered the lakes, recovery decreased due to an increase in the value of flotation tailings. This condition continued till January, 1941, when a form of water-conditioning was put into practice which brought flotation results back to normal. The extraction reached a new high and tailings loss a new low.

Ore is hoisted from the mine in 1-ton cars to a 200-ton circular steel bin. Primary crushing is done by a 24x15-in. Superior jaw crusher. Secondary crushing is done by a No. 7 Newhouse gyratory, which is fed the oversize from a 3x6-ft. low-head Allis-Chalmers D.D. screen operating in open circuit.

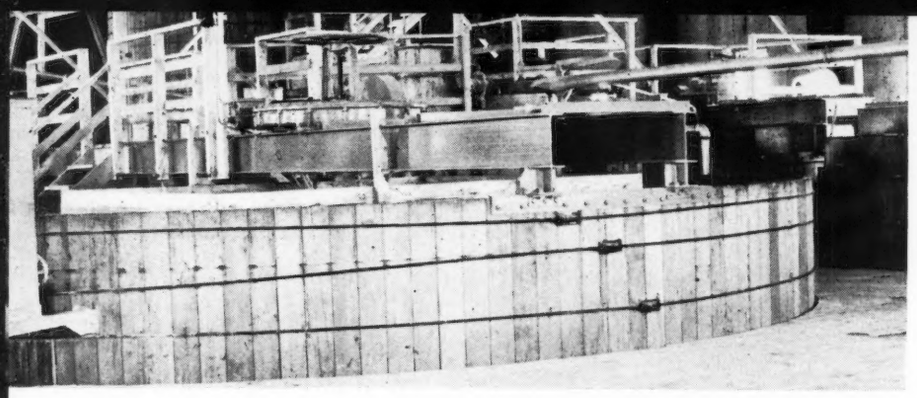
Crushed ore is conveyed to the 360-ton wood-stave mill bin. Grinding takes place in a 6x8-ft. Allis-Chalmers overflow type ball mill. The ore is not hard and ball consumption is 1.2 lb. of chrome steel balls per ton milled. Sorel manganese-steel shell liners lasted for one year. As yet, the end liners have not been removed. The 165 tons of ore per day are ground in cyanide solution.

The ball mill discharges over a 12x15-in. duplex Denver mineral jig, concentrates from which are amalgamated. A 5x23 ft. 4 in. DSFH Dorr classifier rakes a return load of five times the original feed back to the ball mill. Classifier overflow, maintained at 38 percent solids, ground to pass 73 percent through 200 mesh, is pumped by a 3x3-in. S.R.L. Allis-Chalmers sand pump over a 38-in. by 54-in. corduroy blanket table set at a slope of 1 in. per foot of length, to a 16x17 ft. Dorr agitator. Agitation here takes place at 32 percent solids. The corduroy blankets are washed every eight hours and the concentrates are amalgamated together with those from the jig.

From the first agitator, the pulp is transferred by an air lift to a 24x12 ft. two-compartment Dorr balanced tray thickener. High-grade thickener overflow solution is piped to a Merrill-Crowe clarifier and the underflow at 64 percent solids is pumped by a 4-in. Dorreo duplex suction pump to a second 16x17-ft. Dorr agitator, where it is diluted to 50 percent solids. Agitator discharge goes to a second 24x12 ft. two-compartment Dorr balanced tray thickener, the solution overflowing from which joins primary thickener overflow for clarification. The underflow from this secondary thickener is pumped at 64 percent solids by a 4-in. Dorreo suction pump to an 8x10-ft. Oliver filter, the filtrate from which returns to the cyanide circuit. The filter cake is heavily washed with water, discharged at 15 percent moisture, repulped with aërated water, and then continues on its way to the flotation circuit.

To keep the canvas in good condition the filter gets a light acid wash daily. This is to assure a low soluble loss and low content of lime and cyanide in the flotation pulp.

The Merrill-Crowe vacuum unit precipitates 500 tons of solution per day and is equipped with a device for pre-



One of two balanced tray thickeners used in the cyanide section of mill

coating clarifier leaves with Filter-Cel. Precipitate is recovered in two Perron presses, cleaned up every two weeks and refined together with the sponge gold from amalgamation.

Precipitation results are consistently good. Burlap with a layer of cotton sheeting forms the filtering medium in the presses. The same burlap has been used for six months and is still in good condition. The sheeting is changed every two periods, and then burned with the precipitate.

Cyanide solution strength is maintained at 1.2 lb. KCN and 0.4 lb. CaO per ton of solution. Reducing power is tested daily and best results have been found at about 130 c.c. of N/10 $KMnO_4$ per liter of solution (0.08 lb.). Litharge at the rate of 0.08 lb. per ton of ore is added to the ball mill feed. Milk of lime is added at the thickeners and cyanide at No. 1 agitator by a drip feeder.

Amalgamation — Concentrates from the Denver jig and corduroy blankets are ground and amalgamated in a 3x4-ft. Denver rubber-lined ball mill, which is used in conjunction with a Denver mercury saver. A 350-lb. charge of 2-in. cast balls is used for grinding.

Total concentrate sent to amalgamation is about 1,800 lb. For efficient use of the separator a fine grind requiring nine hours to complete is needed. Water is added to dilute the pulp, but no reagents are used. After grinding, the mill is stopped, the door removed, and all the fine slime is decanted and run to the classifier before it can settle. This slime is, apparently, detrimental to amalgamation, so it is removed together with the fouled solution. There is considerable arsenopyrite in the concentrates and decantation helps to prevent interference with amalgamation.

After decantation 4 lb. of lead acetate dissolved in hot water, 2 lb. lime as a thick slurry, and 2 oz. ammonium chloride are added. The barrel is rotated for 30 minutes to insure a good mix, 16 lb. of mercury is added, and the mill is run for 1½ hr. It is then stopped and sufficient water added to thin the pulp for easy flow through the separator. Amalgam and mercury are reclaimed in the latter, and the overflow runs over a corduroy blanket table to the classifier.

The barrel is first rotated a few times, then stopped, and the blankets are examined for "rusty" gold. This

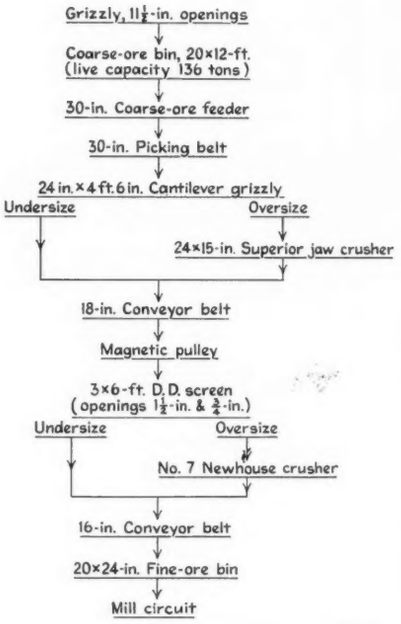


Fig. 1—Flowsheet of crushing circuit of Cochenour Willans mill

type of gold, occasionally encountered, is hard to amalgamate and must be conditioned with muriatic acid, which is added to the barrel 20 minutes before discharging. The mill is then discharged and the amalgam cleaned up. This practice has been fairly successful. Rusty gold thus collected on the blankets is re-run when sufficient accumulates.

Flotation—Repulped filter cake, containing 0.05 lb. of KCN and a trace of CaO per ton of moisture, is conditioned in two 6x6 ft. Denver conditioners connected in series, whence it is pumped by a 3-in. S.R.L. rubber-lined pump to the flotation machines. Nine 3½x3½-in. Denver Sub A cells are used as roughers, and two more as scavengers. Froth from the roughers is cleaned first in two 3½x3½-in. cells and finally in a single similar cell. Cleaner tailings return to the roughers. Scavenger concentrates are returned to the second conditioner. Final tailings pass over a 38x54-ft. corduroy blanket table to waste and blanket concentrate is dumped into the concentrate thickener.

Cleaned flotation concentrate is passed through a Denver 11x6-ft. thickener, which acts as a storage tank because no thickening is necessary. The underflow is pumped by a 2-in. Dorrco duplex pressure pump to a 4x4-ft. Denver filter, discharging a cake at 12 percent moisture. No effort is made to obtain lower moisture content. The concentrate is packed in cotton bags

Table I — Analysis of Cleaned Concentrate With and Without Heating the Flotation Pulp

Heated—Temperature 65° F.	%
Total insolubles	13.10
Total sulphur	18.64
Iron	24.02
CaO	7.66
$CaCO_3$	13.67
MgO	5.83
$MgCO_3$	12.19
As	12.98

Unheated—Temperature 54° F.	%
Total insolubles	13.52
Total sulphur	19.35
Iron	22.89
CaO	9.26
$CaCO_3$	16.52
MgO	5.28
$MgCO_3$	12.76

The point to be observed is that there is not a great deal of difference in the above analysis and that the greater bulk of concentrate acquired when heating the pulp is not from insoluble or gangue minerals. This information might be of interest to those who are handling base metals of economic value.

Table II—Extraction for March 1941

	%
Amalgamation	28.50
Cyanidation	45.10
Flotation	21.60
Total	95.20

Table III—Costs Per Ton of Ore Mined

Amalgamation and Cyanidation	
Crushing and conveying	$0.109
Amalgamation	0.098
Grinding and classifying	0.347
Thickening and agitating	0.095
Filtering	0.077
Clarification and precipitation	0.074
Reagents	0.237
Laboratory and assaying	0.119
Refining	0.023
Heating	0.116
Total	1.295

Flotation—Ratio of concentration 30.8 :1

	Per Ton Milled	Per Ton Concentrate
Flotation	0.306	9.415
Bagging	0.110	3.365
Freight	0.906	27.845
Smelting	0.409	12.589
Total	1.731	53.214
Total costs	$3.026	

Table IV—Screen Test of Classifier Overflow

Mesh	%	Cumulative %
65	2.1	2.1
—65 +100	6.6	8.7
—100 +200	18.4	27.1
—200	72.9	100.0

Table V — Reagents Consumed Per Ton of Ore Milled

Cyanidation and Amalgamation	Pounds per Ton
Balls	1.200
Cyanide	0.867
Lime	1.774
Zinc	0.065
Lead acetate	0.081
Filter-Cel	0.065
Litharge	0.081
Mercury	0.010
Muriatic acid	0.156
Flotation	
Xanthate	0.227
Pine oil	0.076
Sodium hydroxide	0.658
Copper sulphate	0.436

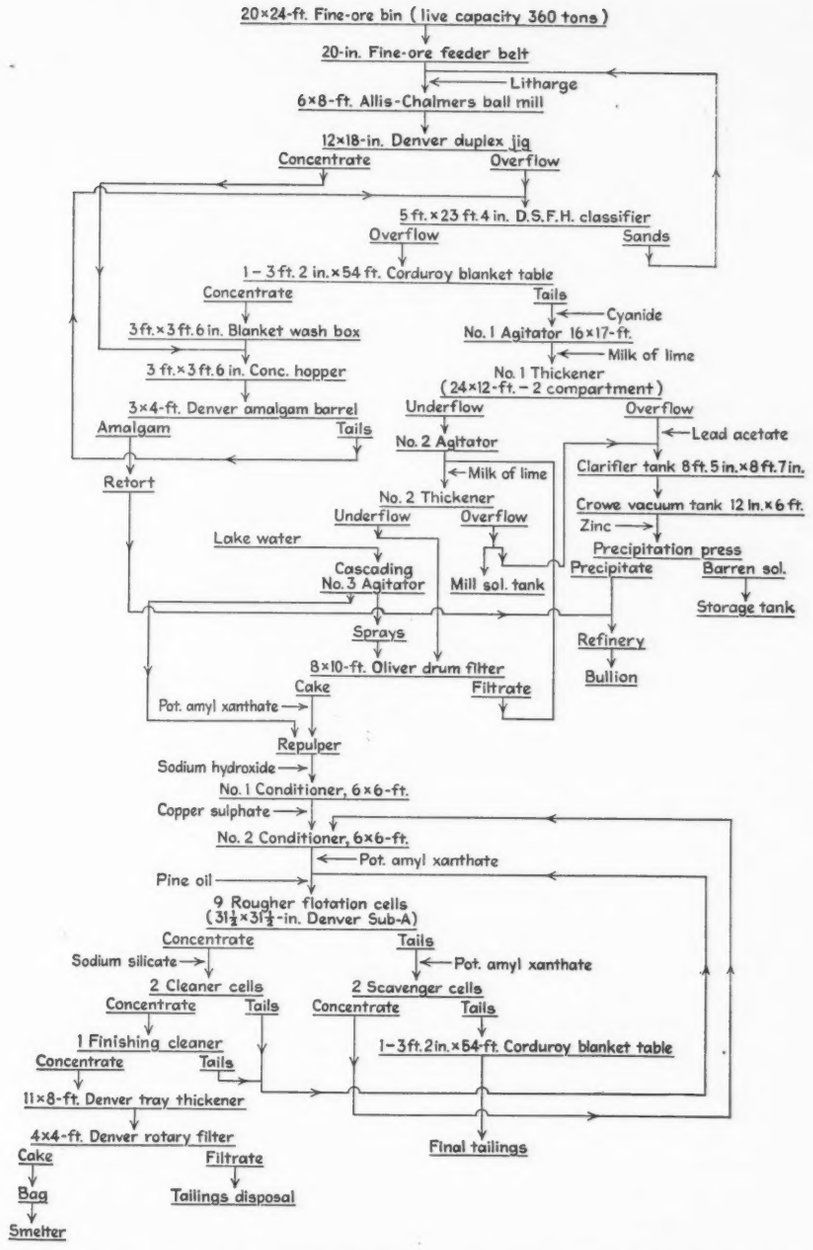
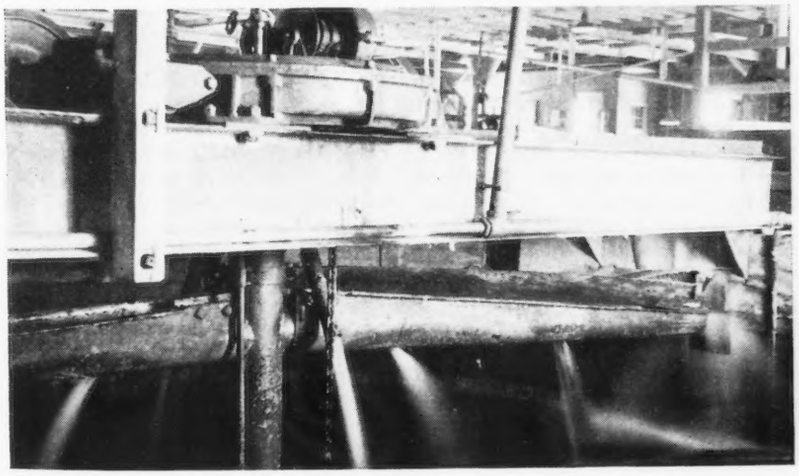


Fig. 2—The mill circuit includes amalgamation, cyaniding, and flotation of the cyanidation tails



Agitator employed for aerating lake water used in repulping tails from cyanidation prior to flotation

holding 85 lb., which at present are stored on the property.

The reagents used in flotation are sodium hydroxide, potassium amyl xanthate, copper sulphate, and pine oil. Xanthate is added as a 10 percent solution by Denver cup-type feeders. Twelve percent goes to the filter repulper ahead of the conditioners, 70 percent to the intake box of the 3-in. S.R.L. sand pump, and 18 percent to No. 7 rougher cell. Sodium hydroxide is fed to the first conditioner. The feeder is a discarded oil drum with an outlet near the bottom equipped with a screen to prevent solids entering the discharge pipe. Five-pound lots of NaOH are placed in the feeder and renewed as necessary. Sufficient atomized water spray to produce a pH of 10.80 in the flotation machines is played on the surface of the sodium hydroxide. A similar type of feeder consisting of a wooden litharge barrel with a perforated wooden screen is used to dissolve and feed copper sulphate. Half-inch hose carries the liquid to the second conditioner and the feed rate is controlled by means of the water spray. Both feeders give satisfaction. Pine oil is added by means of a Denver cup feeder to the first rougher cell. Best flotation results are obtained when the reagents are fed in the manner described.

Pulp is maintained in the conditioners at 56 percent solids and in the cells at 38 percent solids. About 5 tons per day of concentrates are recovered, giving a concentration ratio of 30.8 to 1.

Water Conditioning—As stated previously, flotation results steadily deteriorated with the onset of winter in 1940. In an effort to find the reason, tests were run, different combinations of reagents and their points of addition were tried, and the speed of the flotation machines was increased. The temperature of the pulp in the conditioners was raised to 55 to 65 deg. F. None of these changes showed the desired improvement.

H. W. Shoemaker, consulting metallurgist, suggested that organic matter which he noticed in the water of a neighboring mill might be causing this difficulty. Dorr Co. engineers also suggested that the water might be devoid of dissolved oxygen. With this in mind a number of flotation tests were run, in half of which mine water was used and in the other half, lake water. Reagents, pulp densities, etc., were identical in each pair of tests. These indicated a 10 percent reduction in tailing loss with mine water, due, no doubt, to the presence of more dissolved oxygen. It was therefore decided to use mine water in the flotation circuit.

However, due to the difficulty and time required to pipe water from the mine, it was decided first to experiment in conditioning the lake water. A spare 16x17-ft. agitator was thoroughly

washed out, filled with water, and the mechanism and air lift were started. Water level was maintained 6 in. below the end of the distributing arms. The action of the air lift and the cascading of water from the distributing arms saturated the water with air.

This aërated water was used to dilute and make up the flotation feed from filter cake in the repulper. When aërated water was used the flotation machines produced a stable froth with small tough bubbles in which the gold-bearing sulphides floated easily. The recovery by flotation was increased 16 percent and this has been consistently maintained since the change from raw lake water was made. With raw lake water the froth on the machines was found to be "dead," with large brittle bubbles.

There may be some tendency to supersaturation of the water with air in the agitator and some of the bubble formation in the flotation machines may be caused by the excess air coming out of the supersaturated water. The ratio of concentration was decreased slightly by the use of aërated water.

The water enters the aëration tank at 34 deg. F. and is warmed in the tank by the heat of the building to 37 deg. F. When mixed with warm filter cake from the cyanide circuit and steam-heated during the winter in the conditioner the pulp temperature in the flotation machines is 54 to 56 deg. F. Tests showed that an increase in pulp temperature in the flotation machines to 60 to 65 deg. F. maintained by heating the water in the aëration tank to 55 to 60 deg. F. increased the amount of sulphides floated but did not increase the amount of gold recovered. It was discovered that higher pulp temperatures promoted the flotation of barren sulphide minerals, mainly pyrite. As there was no advantage, the water is not heated in present operation.

Aërated water is used as a spray wash on the cyanide circuit filter and it is thought that its use here may have increased extraction in the cyanide circuit. The importance of "conditioning" water drawn from ice-covered lakes is now being realized by other operators, and at places where the system described has been adopted there has been an improvement in milling results. The poor results obtained in flotation using raw lake water may have been due to the depletion of the oxygen content by the organic matter in the water, or by some other chemical action by the organic matter detrimental to flotation. Aëration of the water before use, however explained, has improved the metallurgy at the property in Canada described.

I appreciate the interest and encouragement of W. P. Mackle, mine manager, which has been of great assistance during the investigation and adjustment of flotation conditions.

Placer Valuation in Alaska

III—Caisson sinking . . . Two other applications of the volumetric factor

L. C. Doheny
Fairbanks, Alaska

IN THAWED, shallow, loose ground, drilling results have seldom shown the full value. The loose gravel allowed the gold to get below and to the side of the casing shoe.

Much of the ground prospected thus was later worked and showed a higher value than the prospecting had indicated. Shafts were tried next; and steel caissons, large enough to allow working space, were used in the loose, wet ground. A small power pump and hose were used to keep the water to a working depth inside the shaft.

Here it was found that once a wet horizon was passed, the fine sand and water passed down along the outside of the caisson and entered the shaft through the bottom. The larger rocks that would have added to the volume did not get into the material dug from the shaft. When gold was in the same horizon as the water, it had more of a tendency to carry down because of its higher specific gravity and small size. A bad over-run resulted, as a lean horizon below the one with values was salted with gold that did not occur there.

Even when a measurement on the loose volume excavated was made, there was not enough increase to note the correct over-run. The fine black sand and gold that came into the shaft from a higher horizon was hidden in the void space of the loose material.

In one instance, the recovery by dredging showed a value of 16c. per cubic yard. A caisson hole was sunk alongside the dredge cut; but the hole was badly salted, inasmuch as there was a heavy run of ground water coming from the upper of two pay horizons. The accompanying diagram illustrates this particular case. The gold and fine sand that had entered the shaft from the sluicing action did not increase the volume over and above the expected swell that is normal in this work. The result was that the shaft was calculated at 70c. per cubic yard.

A second shaft was sunk alongside the first; and provisions were made to keep the center of the excavation high and away from the danger of being salted by the water and sand coming in below the cutting edge.

When the higher pay horizon was located, a small sample (about 0.5 cu. ft.) was taken for every foot in depth from that island. This sample was both panned and screened. The screening was done to get at the plus-and-minus $\frac{1}{8}$-in. material; the panning indicated the gold content that could be expected, although this was not used for the valuation.

A similar screen test was made on the material excavated from the bottom of the shaft that included the material sluiced down from above. When a comparison was made, it was found that the ordinary gravel contained 430 percent more minus $\frac{1}{8}$-in. material than the samples cut from the island, although the loose volume did not show an abnormality to that extent.

The second shaft was calculated in the same manner as the first. The result was 74c. per cubic yard. After applying the correction of a 430 per cent over-run, the value was cut down to 17.2c. per cubic yard, which was a close check on recovery by dredging.

In the instance cited, the division (of the plus-and-minus $\frac{1}{8}$-in. material) was made with ordinary galvanized screen. No finer size was available in the remote place where the work was done. It is highly probable that, with the use of a standard Tyler screen set, the over-runs, so common to caisson work, could be cut down to give accuracy in prospecting. The $\frac{1}{8}$-in. mesh used in this particular case would not necessarily be the critical size for all this type of prospecting.

Volumetric Valuation—A previous discussion explained the method of placer valuation by the use of the cleaned, slimed, residue recovered from the drill holes. Since it was written two new uses of this same method have been found. One was to determine the value of the gravel in an open hole in frozen ground which had sluffed after the drilling process was completed and before a water displacement measurement could be made. The other use applied the volumetric factor in reverse in thawed ground to obtain the standard. Each case is discussed separately as follows:

Sluffed Holes in Frozen Ground—Open placer drilling in frozen ground is done to the best advantage when the atmospheric temperatures are lower than freezing. If the same prospecting is done in a warmer season, ice and

ice water are used to keep the hole from thawing and sluffing. However, there are times when there is no ice available and it becomes necessary to drill an open hole in frozen ground. Although in certain types of ground this can be safely done, a loose formation will sluff to give a large size hole. Very often the resulting water measurement is not reliable.

In the particular instance cited here, the holes were drilled during late August. Out of 19 holes the upper gravel caved down into the bottom of seven before a water measurement could be taken. The work was discontinued until colder weather. A hole was then drilled at a distance of 5 ft. from the original location of each of the seven holes in which the gravel had sluffed.

The volume of cleaned solids recovered from each sluffed hole was used to indicate the total volume sampled. The original 12 completed holes provided this relation of solids to the total volume sampled. This determined the basis for the value per cubic yard.

The values shown by the check holes were compared with those obtained in the sluffed holes. The largest difference between any check and original was 12 percent. One hole checked to within 1/10 of 1 percent. The difference between the two sets was only 2 percent, or well within the probability of the gold occurrence.

In this case the sluffing occurred in the upper blank gravel. It is possible that all sluffed holes could not be calculated in this same manner. Use of this method proved that check holes were unnecessary in this particular instance.

Standard for Thawed Ground—In one placer deposit, comparable to deposits in California, there was no frozen ground from which a standard volumetric control could be obtained. Here the actual production and the results forecast by the prospecting were compared after eleven clean-ups. Five of these had shown the recovery over estimate to be about 250 percent. The next two areas were very close to 100 percent; four more were only 50 percent of the expected recovery.

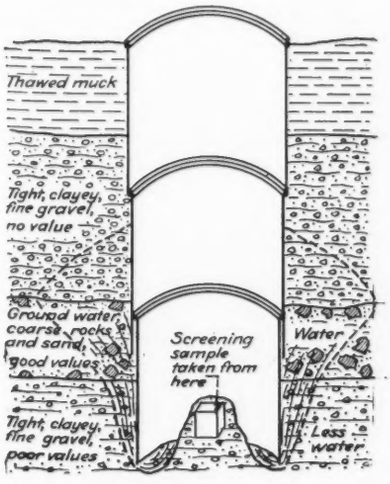

Thawed muck
Tight, clayey, fine gravel, no value
Ground water, coarse rocks and sand, good values
Screening sample taken from here
Water
Tight, clayey, fine gravel, poor values
Less water

Diagram illustrating how a caisson hole was salted by ground water from an upper pay horizon

An examination of the drill logs in the whole area showed that there were very small volumes of cleaned, slimed solids in all the first five areas. These ranged from 0.025 to 0.120 cu. ft. per linear foot through the pay horizon. The drill casing in this prospecting was 6 in. and the cutting shoe 7½ in. in diameter. This is equivalent to an area of 0.306 sq. ft. and to a volume of 0.306 cu. ft. per foot of depth.

As the recovery was 250 percent over the estimate, the reciprocal of this would be 40 percent. The weighted averages of all the cleaned, slimed solid volumes came to 0.07 cu. ft. per linear foot in the lower pay gravel. Taking this as only 40 percent we then have

$$\frac{0.007 \times 100}{40} = 0.175.$$

Then 0.175 cu.ft. of cleaned, slimed solids was the entire amount that should have been recovered from the average one foot of prospecting in the pay horizon. The cleaned, slimed residue was $\frac{0.175}{0.306}$ or 57.2 percent of the pay gravel.

Next, each drill hole was re-calculated and the value per cubic yard was stepped up to compensate for the deficient volumes.

The block of ground in the first five clean-ups was revalued and the recovery over estimate then became 109 percent. The highest recovery over estimate for any particular clean-up was 123.4 percent; the lowest was 91 percent.

Consequently, a large body of reserves adjoining this area will now be worked. Previous to this study these were considered to be below the limit of economic dredging in value.

Then the four clean-ups that gave only 50 percent of the expected value were examined in the same manner. The drill records showed that this area had artesian water pressure and that excess volumes had entered the casing. The volume of cleaned, slimed solids was again applied. The holes affecting this area were cut down to a lower value. The changed value when applied to the block showed 117 percent of the average recovery expected. The separate clean-ups varied only within 5 percent of the average.

The area wherein the two clean-ups recovered 100 percent of the estimate were in the cross-over between the first area, where the drilling process pounded out the value as well as the gravel, and the other area where the artesian pressure had blown an excess of the pay horizon up into the casing. In the system used, the revalued holes compensated each other to a final recovery over estimate of 94 percent.

The work described demonstrates that it is possible to obtain a fairly accurate estimate of the value of thawed placer ground by working backward to the cleaned, slimed volume factor. However, it is readily seen that if several pay horizons were all dredged at the same time, and if each of these had a different solids content, the problem of establishing a standard would be most difficult.

This same method when applied to ground containing boulders met with no success. It is probable that in this later work, some of the drill holes went through decomposed barren boulders. It is also likely that the dredging did not recover all the gold in the ground.

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Shocks Eliminated by 6-Volt Cords

IN ALL PLACES where alternating current is available for extension-cord lighting these cords can be made absolutely safe as to shock by adopting a practice of the Public Service Gas & Electric Co. of New Jersey. The cords are equipped with 50-watt 110/6-volt transformers and use 6-volt lamps which are now said to be available with standard screw bases.

Because of the steel framing of buildings, or the presence of mine track rails flush with the floor of repair shops, or purposely grounded motors and so on, the hazard of a shock to ground from an extension cord is nearly always present and is greater at mines due to wet places, such as pumping stations and washing plants. The following from a recent number of Public Utilities Safety published by National Safety Council details the development:

"There seems to be a belief among workmen that 110 volts is not harmful and can produce fatal shock only in cases where a man has a weak heart. This is not true. Tests have been conducted which show that when an electrical circuit is completed through a wet contact, any voltage in excess of 12 volts is dangerous.

"Realizing the hazard that existed when work was performed in wet or damp locations that provided a perfect ground for the 110-volt circuit should extension lamps become defective, the electric generation department of the Public Service Electric & Gas Co. in 1928 decided to have one of the local manufacturers design and develop a 110- to 32-volt 50-watt transformer. During that year, 1928, all 110-volt extension cords were replaced with the new 32-volt transformer.

"In 1939, however, as a result of further experimentation, this transformer was rebuilt so that its secondary voltage was reduced to 6 volts, which is recognized as an absolutely safe minimum. It is now possible to procure 6-volt lamps with the standard base. Low-voltage transformers of this kind are being used exclusively about the property to eliminate electric-shock."

A phosphate washing plant in the Florida pebble field, with a 40-ft. hydroseparator desliming the debris at 150 mesh

Particle Sizing and Hydroseparation in Phosphate Recovery

An interesting relationship between dilution and detention time is pointed out

B. J. Larpenteur
Metallurgical Development Engineer
The Dorr Co., Inc.,
New York

RECENTLY an interesting series[1] of articles appeared in *E.&M.J.* describing operations in the Florida and Tennessee phosphate fields, and covering in a general way the economics, geology, prospecting, mining, and washing of phosphate rock. Incidentally they described the recovery of formerly wasted fine material by means of hydraulic classification, flotation, and tabling.

Hydroseparation and classification play an important part in connection with the flotation and table recovery of fines. In strict metallurgical parlance, however, many of the classification operations are really desliming steps, due to the nature of the material treated and the requirements of the end products of the classification steps.

As described in the articles mentioned, the usual Florida pebble washing plant operation following hydraulic mining consists of a combination of scrubbing and screening steps, with recovery of material of suitable B.P.L. grade, down to 14-20 mesh approximately. At this fineness it is usual to encounter contaminating silica particles, with a marked dropping off in B.P.L. content as the fineness increases.

The flowsheet in Fig. 1 shows a typical application of hydraulic and rake classifiers, together with hydroseparation, in connection with a representative Florida pebble washing plant. The hydroseparator, which is a special adaptation of a thickener, supplies the area and detention time required for effecting a separation in the fine-size range of particles, provided sufficient dilution water is added to permit such a separation. The total volume of washing plant "débris" is sent to the hydroseparator, the material that it is desired to recover being allowed to settle out and to be withdrawn as underflow. The overflow, containing most of the water and colloidal slime and particles of rock and sand finer than the desired mesh of separation, is removed at this point and sent to a settling pond, the water being ultimately recovered.

With most of the colloidal slime and water removed from the recoverable fine rock particles, the underflow can then be given metallurgical milling treatment.

In most operations Fahrenwald sizers are used for hydraulic classification in removing the coarsest particles of merchantable or near merchantable grade in the débris. A feed cone usually precedes each sizer. The fine material overflowing the cone joins the fine rock and sand particles discharging from the finer compartments of the sizer, going to the next classification step.

Either single-stage or bowl classifiers are used for this final classification, which precedes flotation or oiled tabling. The essential purpose is usually to effect thorough desliming rather than actual classification.

The flowsheet in Fig. 2 illustrates classification and hydroseparation operations in a phosphate washing plant in Tennessee. Here, because of the fundamentally different nature of the phosphate rock, classifiers frequently play a more important part in the washing plant proper. The hydroseparator, however, functions as it does in the Florida field—namely, for separating a mixture of fine phosphate from slime and water, at a size depending on recovery requirements.

In the hydraulic mining practiced in Florida, and also in the washing plants themselves, a total of 4 to 6 tons of water is added to each ton of crude matrix. After the removal of perhaps 15 to 25 percent of the original dry weight of the matrix as screened pebble washer rock, the washer débris, consisting of nearly all of the water, all of the slime, and the phosphate and silica particles up to 14–20 mesh, receives hydroseparation and classification treatment.

Because of the variations in physical characteristics of the matrix mined, together with variations inherent in hydraulic mining and transportation to the washer, débris characteristics are themselves variable. In some operations these variations have been overcome by use of feed storage bins to equalize surges and interruptions in mining. It is still necessary, however, to provide treatment methods and equipment for peak or near-peak conditions.

In planning operations for recovering phosphate in the débris, whether this comes from current washing or from an old dump, thorough sampling and laboratory investigation determine the character of the additional fine material economically recoverable, its B.P.L. grade, the particle-size separation necessary, the dilution and area requirements for effecting such a size separation, and likewise the metallurgical details of subsequent recovery steps.

The step of principal interest here is the hydroseparation operation made on the main volume of washing plant débris, where large quantities of water, primary slime, and fine silica must be separated from the granular material. Usually this separation is somewhere in the range of 100 to 200 mesh. There is now a definite trend toward

[1] "Phosphate—The Vital Non-Metallic," by A. H. Hubbell, starting in September, 1940 issue.

recovery of even finer material, beyond 200 mesh and even into the micron sizes, by the use of considerably greater hydroseparation areas and dilutions, as well as of chemical dispersants. Here, however, we are dealing only with commonly used current practices in the phosphate fields.

Usually the slime accompanying fine phosphate rock particles in a washer débris is highly colloidal. This is true in the Tennessee field and in the Florida pebble and hard-rock fields. The colloidal nature of the slime, its flocculating characteristics, and the dilution and detention requirements for effecting a size separation at, say, 100, 150, or 200 mesh, vary considerably in different areas of any one of these fields. Conditions in one deposit may be appreciably different from those in another close by. For this reason preliminary laboratory work on typical samples of matrix or débris is essential before accurate prediction can be made as to equipment and water requirements. With proper sampling and other technique, laboratory results are translated into commercial plant requirements accurately.

Because of the peculiarly flocculent nature of most of the phosphatic slimes, there is one noticeable common characteristic. This is the fact that, almost regardless of time of detention (within reasonable limits), a certain dilution must be employed to obtain a particular size separation. This is especially true in the Florida field. In much hydroseparation work (such as in the metallurgical, sand, clay, limestone, chemical, and other fields), a reasonably straight or gradually curving line can be drawn when plotting the relationship between dilution and detention requirements. This definitely is not true in the case of most phosphate slimes. A certain point in dilution must be reached before any particular size separation can be obtained with reasonable detention time. This point is sometimes referred to as a "yield point." When this dilution is obtained, the particles of that size will settle out at a fairly rapid rate. In some areas of the Florida pebble and hard-rock districts, a sample of débris in a graduate will show that 28- or 35-mesh particles will remain in suspension for several hours with practically no settlement. Gradual additions of dilution water will have little effect until the "yield point" for the particular slime medium is reached. At that point settlement of granular particles is quite rapid. The optimum dilution to be used is a critical one.

On many typical Florida débris products as much as two or three parts of fresh dilution water must be added to one part of original débris to obtain a separation in the 150–200 mesh range with reasonable hydroseparator area. After such an optimum dilution is reached, overflow size can be closely controlled by regulation of the water added.

In several Tennessee operations it has been found possible to vary the mesh size of the hydroseparator overflow, similarly in the 150–325 mesh range, by dilution control, once the "yield point" in dilution is reached.

In this proper dilution range a reasonable relationship is found between hydroseparator area and overflow dilution on most phosphate débris products. Below this range an increase in hydroseparator area, even though appreciable, is of little benefit.

With finer recoveries desired and with operations in both the Florida and Tennessee districts being carried out in areas of higher colloidal slime content, hydroseparators of much greater size than those now in use are being installed. Special hydroseparator design has provided a secondary washing on the underflow solids, with resulting higher efficiency of separation. The adaptation of known metallurgical equipment to this special field has required careful study on the part of the operators and manufacturers, with the result that fine separations now being obtained are considerably beyond those attempted a few years ago.

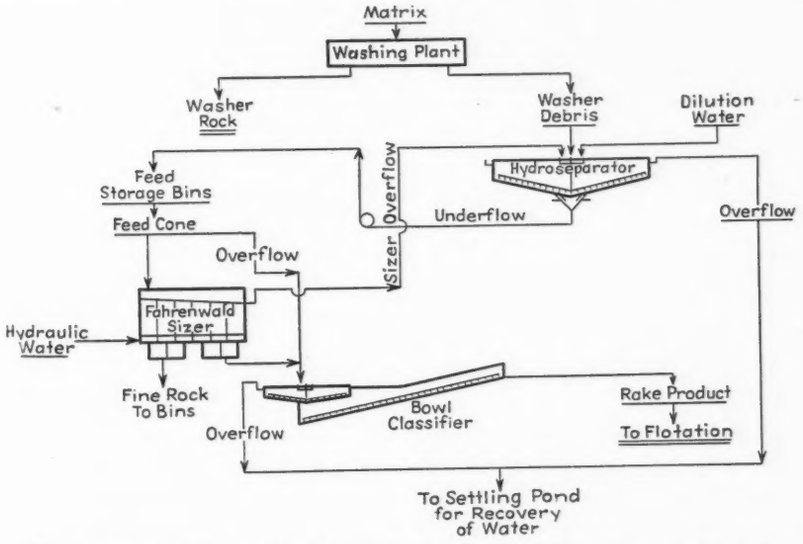

Fig. 1.—Flowsheet of a washing plant in the Florida pebble field, showing typical application of hydraulic and rake classifiers and hydroseparator on debris recovery

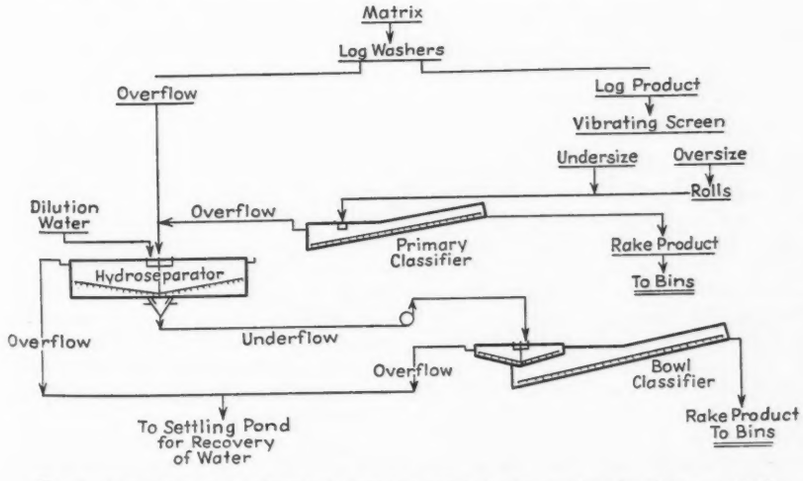

Fig. 2.—Flowsheet of a phosphate washing plant in Tennessee, showing a typical application of classifiers and hydroseparator

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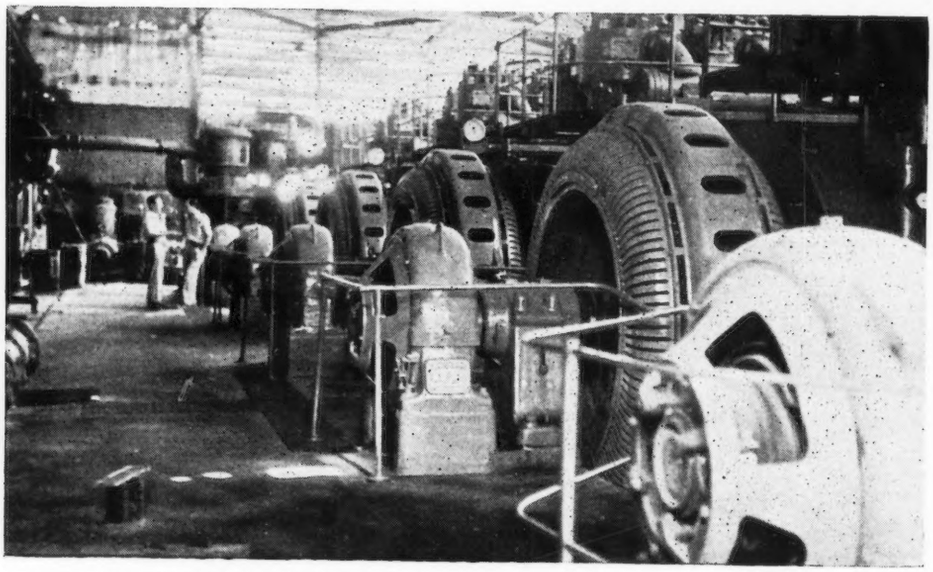
Seeking Safety Instructors

THE Federal Civil Service Commission has announced that it is recruiting safety instructors for positions in the Bureau of Mines. The salary is $1,800 a year. Appointments will be made in the fields of coal and metal mining, quarrying, tunneling, and petroleum. All applications for the written general test must be on file with the Civil Service Commission, Washington, D. C., not later than March 30, 1942. Two years' experience is required in a responsible position such as mine or section foreman, shift or fire boss, or safety inspector or engineer in the mining or petroleum industries. Applicants must be between 25 and 35 years of age.

Venezuelan Gold from El Callao

The lode mines of two companies yield most of the country's output



Generators driven by producer-gas engines in the power plant at El Peru mill of New Goldfields of Venezuela, Ltd.

N. B. Knox
Box 1634, Caracas, Venezuela

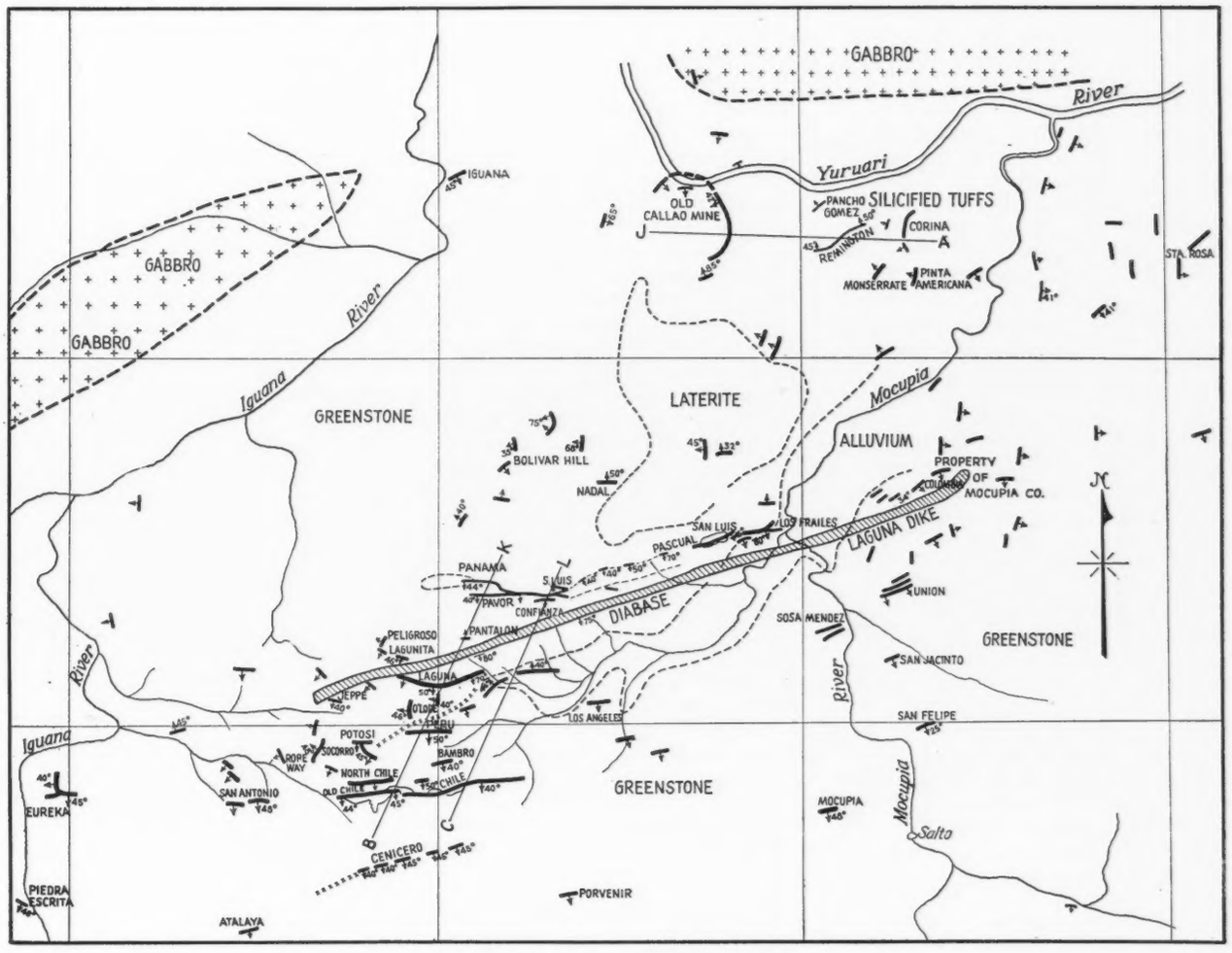
GEOGRAPHICALLY and geologically Venezuela is roughly divided into two sections, one north and the other south of the Orinoco River. The eastern half of the southern section forms the State of Bolivia. This region, also known as Venezuelan Guayana (or Guiana), is composed in its northern part of isolated hills and ranges up to 2,000 ft. high, separated by wide expanses of gently rolling savannah grained by dark, sluggish rivers. Rainfall is confined to a wet season lasting from May to November and averages 40 to 60 in. Cattle are raised in the savannah, but the sandy soil is generally of little value to agriculture.

The rocks underlying the northern parts of the state of Bolivia are granite gneiss, hornblende gneiss, and sericite schists, with some iron-bearing quartzites, the whole intruded by granites, pegmatites, and aplites. These are the ancient rocks of the Brazilian shield, of which the region is the northern extension. In the southern part of the State these rocks are covered by a considerable thickness of later quartzitic sandstones, and conglomerates and shales of probable terrestrial origin. These form the Roraima formation, which, because of their joint systems, gentle dips, and contrasted resistance to erosion, comprise a great area of remarkable mesas —some more than 6,000 ft. above the rolling country which surrounds them. In these mesa lands lie the boundaries with Brazil and with British Guiana, and it is here also that a small, local placer-diamond rush took place some time ago.

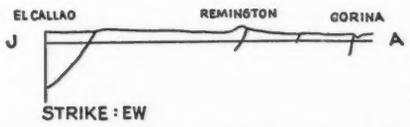
The most important gold mineralization is centered at El Callao, a district which in the 'sixties and 'seventies was one of the world's leading producing regions. The El Callao mine itself alone produced 175,000,000 gold francs from 3-oz. rock treated in a 60-stamp mill. This camp is situated about 200 km. air-line southeast of Ciudad Bolivar, the State capital on the Orinoco. It is reached by poor dirt roads either from Ciudad Bolivar (300 km.) or San Felix (180 km.), also on the Orinoco. Most of the supplies for the district are trucked in from San Felix over a road which has cost over Bs. 900,000 (bolivianos) ($250,000) up to the present. Trucking charges are Bs. 85 ($25) per ton. There is a regular plane service that is maintained to the neighboring village of Guasipati.

About 95,000 oz. of gold is produced annually in the El Callao district out of a total for Venezuela of 114,000 oz. (1938), but, aside from the metal obtained from alluvial washing with the *batea,* the only production in the district is from two hard-rock mining companies—the Mocupia, a French company, and the New Goldfields of Venezuela, Ltd., which is British. These companies have their properties a mile or two south of the town of El Callao in a series of rocks of strikingly different aspect from the gneisses of the basement complex. These are greenstones composed mainly of quartz and chlorite, and calcite and some locally silicified tuffs. They form a range of hills rising about 1,000 ft. above the savannah and are thickly covered with brush. At the surface the greenstones are generally badly weathered; however, it can be observed that close to shear zones a schistosity has been induced in them producing a blocky chlorite schist. Inasmuch as many orebodies have been formed in these shear zones, this fact has been of value in locating the outcrops of some of the veins.

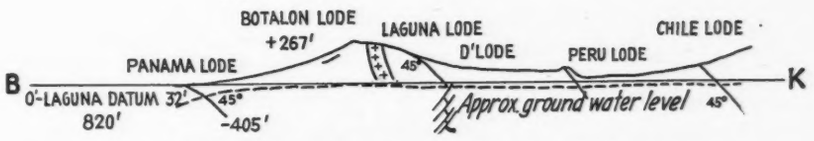
A great number of quartz veins outcrop and all of them contain some gold. A few have rich oreshoots and are mined or held as reserve. These veins



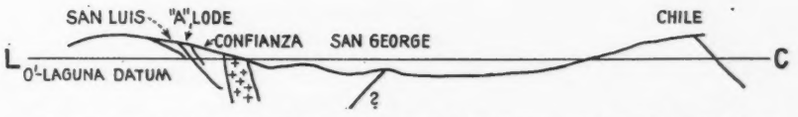
A geologic sketch map of El Callao district



An approximate cross-section from El Callao to Corina on line J-A on accompanying map



Cross-section from Panama shaft to Cenicero shaft, line B-K on map



A cross-section through San Luis, Confianza, San George, and Chile. line L-C on accompanying map

vary considerably in dip, but the strikes are almost all in the northeast-southwest quadrants; the east-west strikes that are found in the western part of the district turn to the north as the veins approach the Yuruari River on the district's eastern margin. A great, post-mineral, basic dike, striking N. 70 deg. E. and standing almost vertical and 120 ft. thick, intrudes and separates the orebodies. It is remarkably persistent and can be followed for 3½ miles. Mineralogically, it is composed of 65 percent labradorite and 35 percent augite, with some magnetite and biotite. It appears to have a diabasic texture.

Notably, the strikes of the basement gneisses also are in the northeast quadrant. They surround the mining district and presumably underlie the greenstones.

The veins themselves occupy thrust faults, and are cut by subsequent steeper thrust faults of small displacement. The great diabase dike is associated with one of these steep thrust faults.

The inclosing greenstones, as previously mentioned, have been altered to a chlorite schist near the veins; often they are silicified, and although sharply defined walls are the rule, the greenstones are occasionally so completely replaced by quartz as to present a continuous gradation from wall rock to vein. They are often heavily pyritized.

Most of the quartz was introduced before the gold, but not all of this quartz was fractured at the time of gold introduction. Hence the veins contain great masses of white, valueless quartz. On the other hand, in some cases the greenstone was sufficiently

mineralized to constitute ore. Thus the orebodies are limited only by assay walls, which vary considerably from year to year. Furthermore the orebodies are irregular, varying considerably in dip and thickness (from 30 ft. down to a few inches). The veins occasionally branch and may pinch to scarcely perceptible stringers, and thus form lenticular masses. Aside from quartz and gold, the only other minerals present are calcite, ankerite, tourmaline, pyrite, and rare grains of chalcopyrite.

Mining is being carried on by New Goldfields of Venezuela in several different veins, each of which forms a separate orebody mined as a distinct entity. All are connected by rail with the company's El Peru mill. The mines now producing, together with the percentage of ore milled, are: Laguna (underground), 41 percent; Union, 34 percent; Sosa Mendez, 9; Laguna (surface), 8; Chile, 6; and Panama, 2.

The total daily tonnage sent to the mill is 600 t. At present the Laguna vein is the most productive. It can be traced for about half a mile and averages 4 ft. in thickness. Ore is found chiefly where the dip is irregular, and some stopes even appear to undulate. Much of the gold is in easily visible stringers and grains. High-grading is such a problem that certain stopes have been endangered, owing to the robbing of the pillars by unauthorized persons. Near the surface the vein has three branches and the wall rock carries some mineralization, so that it is worked as an open cut 150 ft. deep, excavated in the hill that contains the vein. Below the open cut an adit has been driven 1,000 ft. into the hill, and from it a vertical two-compartment shaft has been sunk to the seventh level (700 ft.). Drifts have been opened every hundred feet and the oreshoots stoped out between the drifts by overhand and underhand methods. Pillars are left where the hanging wall requires it, but very little timbering is necessary. The displacement of the vein by a series of steep thrust faults is not very great, so that up to now it has been possible to mine the vein as a connected unit except where the vein has been interrupted by the diabase dike.

At the Union Mine

Second in importance in present production is the Union mine. Here the structure of the vein in the shear zone is more complex. Lenticular masses of vein matter occur in a wide band dipping and striking N. 60 deg. W. On the surface they appear as three separate parallel orebodies, but underground they join and form a lode which pinches and widens and branches repeatedly. It appears that thick almost perpendicular oreshoots occur where cross-faults cut the main shear zone. Wall rock replacement is particularly notable in this mine. Some parts of the hanging wall consist of slabs of silicified wall rock supported only by gouge; hence parts of the mine are supported by square sets.

Now under construction is a 2,000-ft. haulage level to connect the Union mine with the neighboring Sosa Mendez property, which is on the same lode system as the Union and is separated from it only by the shallow valley of Mocupia Creek. The same structural conditions persist into this property.

Half a mile north of the Laguna vein is the Panama mine, noted for its branched vein known as the Pryor and Lode A, which strike east-west and dip 45 deg. S., and eastward become one single vein. No boundary can be distinguished between the two branches. The branches thin out and lose values as they separate. A shaft has been sunk 600 ft. to develop these orebodies, which form one of the original exploited mines of the region.

Across the creek from the Panama and the Laguna mines and about three-quarters of a mile south of the latter lies the outcrop of the Chile lode. This lode has undergone much complex faulting, a great deal of it pre-mineral. The ore is found in great lenticular bodies, many of them carrying an ounce of gold or more to the ton. As the ground holds well, many of these bodies have been stoped out entirely, leaving great caverns as much as 30 or 40 ft. wide and twice as high.

Many Other Veins

As can be seen from the geologic map, a great many other veins outcrop in the district. But under present conditions many of them do not show promising quantities or ore. Most of these, however, have not yet been thoroughly explored, and nine-tenths of the company's holdings must be considered virgin.

Ore reserves, as calculated by the management, amount to over 300,000 tons of ore averaging 9.3 dwt. per ton.

Labor is expensive. and the mine is partly mechanized. Mechanical muckers are used at the most important faces. In stopes where, as in most cases, the dip is insufficient to allow all the ore to reach the chute by gravity, small scrapers operated by compressed-air tuggers have given good results. Ore is hauled in 1½-cu.yd. dump cars, raised to the surface in cages, and, in many cases, hauled a considerable distance to the mill. Haulage is by storage-battery locomotive.

One mill handles the ore from all of the New Goldfields' mines. It has a capacity of about 600 tons per day. Treatment is by a combination of cyanidation and flotation. Extraction is 94 percent, working on 11-dwt. heads. About 8,000 oz. of gold are recovered from 17,000 to 18,000 tons of ore per month.

Recently the mill has been rearranged to simplify the flowsheet and adapt it to new conditions brought about by the fact that most of the ore now treated is unoxidized. W. B. Rhodes is in charge of milling.

The total investment represented by the properties at present is over Bs. 40,000,000 ($12,500,000) at the official rate of exchange; the total production by the present company has been about Bs. 70,0000,000 ($22,000,000), covering 41 years of operation. The mine employs over 1,500 men. The lowest wage is Bs. 6.25 per day on the surface and Bs. 7.25 underground. (The value of gold is Bs. 110 per ounce.) Each miner or mucker has a young helper paid by the company to aid him in his work.

Costs average as follows:

	Bolivianos
Horizontal development, per foot	89
Stoping, per ton	16 to 18
Transport to mill, per ton	1.44
Milling, per ton	8
Administration and general expense, per ton	11.27
Total operating costs, per ton	36.50

Power is generated in what is reputed to be the second largest installation of producer-gas engines in the world. Wood is cut from the neighboring hills and brought to the mine for Bs. 20.80 per cord. From a cord of wood 738 kw.-hr. can be generated, bringing the cost of power to Bs. 023 per kilowatt-hour. Five engines having 600 b.hp. operate at El Peru. The Union Sosa Mendez group of mines have their own power plant to serve them.

Labor conditions are somewhat peculiar in Venezuela. The economy of the whole country is based mainly on its production of oil. Exportation of petroleum and gold pays for the importation of all other goods. The greater part of foodstuffs, wearing apparel, machinery, building materials, etc., are imported from abroad—since the war mostly from the United States. The most important tax collected to support the Government is levied not on incomes or property, which pay few taxes of any kind, but on imports. The great quantity of imports allows this tax to function as an enormous sales tax which helps raise the nation's price level and make it the world's most expensive country in which to live. Hence in proportion to its efficiency, labor is very expensive, for laborers are consumers in an inflated economy. Exchange regulations which have been instituted because of the sudden great demand for dollars have further tended to raise real labor costs.

Importers Pay Higher Rate

These regulations force the importers to pay Bs. 4.00 for dollars for the purchase of their merchandise, whereas the official quoted rate is Bs. 3.19. Prices and wages are then adjusted in the national economy to a Bs. 4.00

dollar. But, mining companies selling their product abroad or gold to the government may receive only Bs. 3.17 for a dollar or a dollar's worth of gold. Hence they are paying all local costs in a boom economy further inflated by high import duties, expensive transportation facilities, and very high middleman's profits based on a Bs. 4.00 dollar while receiving Bs. 3.17 for a dollar's worth of production.

The New Goldfields company handles its labor relations through a special department. Although labor unions are of small political importance, the Venezuelan labor law gives the workman many privileges. He is entitled to a percentage of the operating profits of the company he is working for. He receives special overtime pay, compensation for injuries, and bonuses when he is laid off which vary with his length of service. These payments average 19 percent of the payroll. The company has built sanitary low-rent dwellings for the workmen and maintains a modern 58-bed hospital ably run. Considerable trouble is experienced by mining and oil companies operating in Venezuela in feeding their foreign personnel. Away from the large centers of population it is difficult to obtain fresh vegetables and fruits and properly cut meats. Therefore the company must attempt to undertake the responsibility for providing these commodities for the technicians that reside on the property.

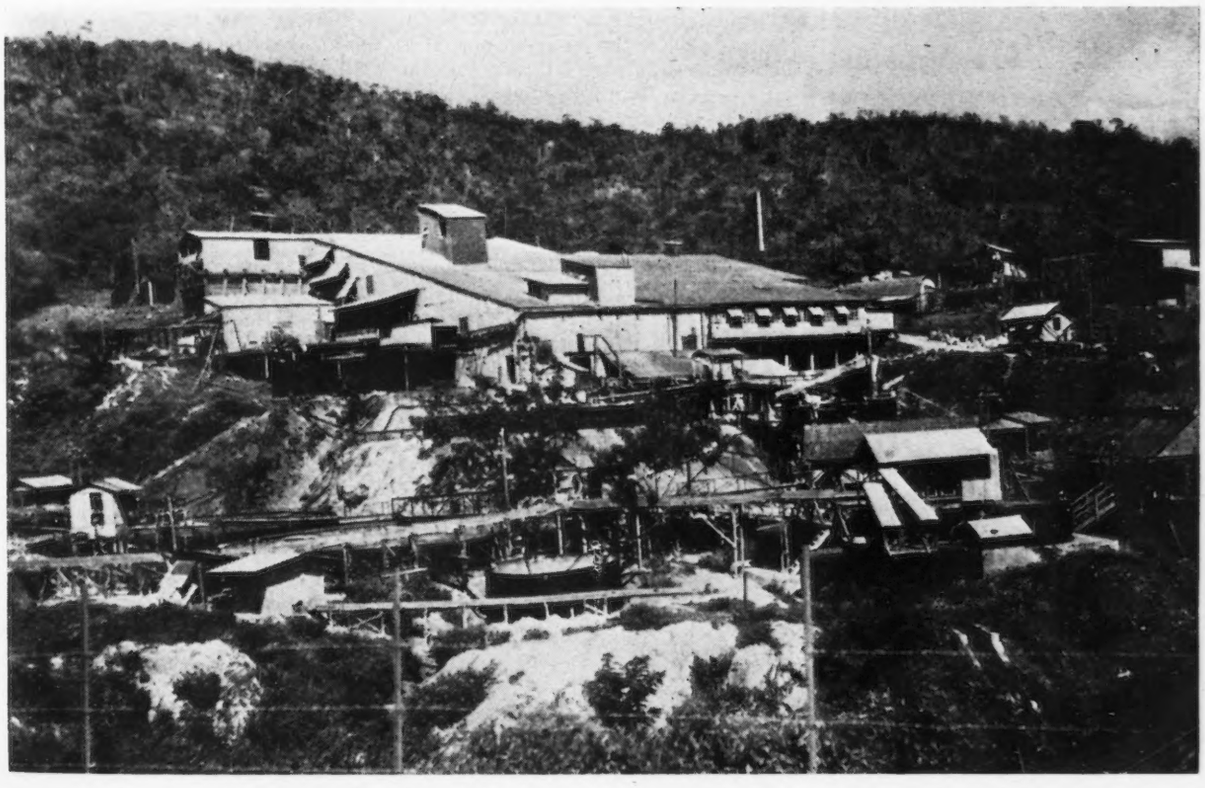
Operations at the New Goldfield's property are under the direction of J. T. Boyd. Eugene Locher is chief engineer and K. P. P. Khadjeff is in charge of surface operations. Until his untimely death recently Albert Oppenheim ably headed the labor relations department.

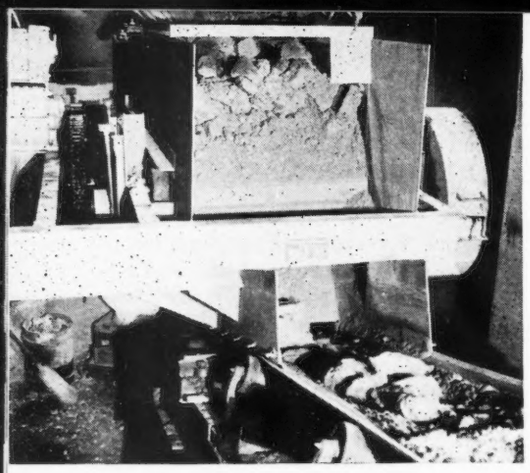
The Mocupia Mining Co. is working the Columbia lode, which is within an enclave in the properties of the New Goldfields company. This vein is similar in structure and mineralization to those of its neighbor and is cut by the norite dike. The company has a 100-ton plant and employs about 300 men. Mining costs, not including any development work, run around Bs. 11.00 per ton. The milling costs average Bs. 17.00 to 18.00 per ton, with a recovery of only 70 percent. The company suffers from lack of development work, which was allowed to fall behind. At the time of my visit there was no millman in charge of the mill, which was poorly set up. Much good ore is probably to be found in the mine, but the company was forced to accept a loan from the Venezuelan Government to be able to continue the operations that were under way.

In general the El Callao district forms the center of a large auriferous region. Fair quantities of good ore are available. But many factors tend to make its exploitation difficult. Roads are poor and usually closed for part of the year; airplane transportation is a Government-supported monopoly and does not offer rates comparable to those with which T. A. C. A. has fostered mining in Central America. Labor experienced in mining activities is scarce, and that which is available is deemed by local mining men to give only 35 percent of the output that would be expected in other countries. The law does not envisage the simple filing of a claim; obtaining a concession is a complex legal procedure. The exchange situation is detrimental to the mine operator. The district is far from Caracas, the capital, and the nation as a whole has had little experience in mining in its history and has difficulty in understanding the various problems that are peculiar to the industry.

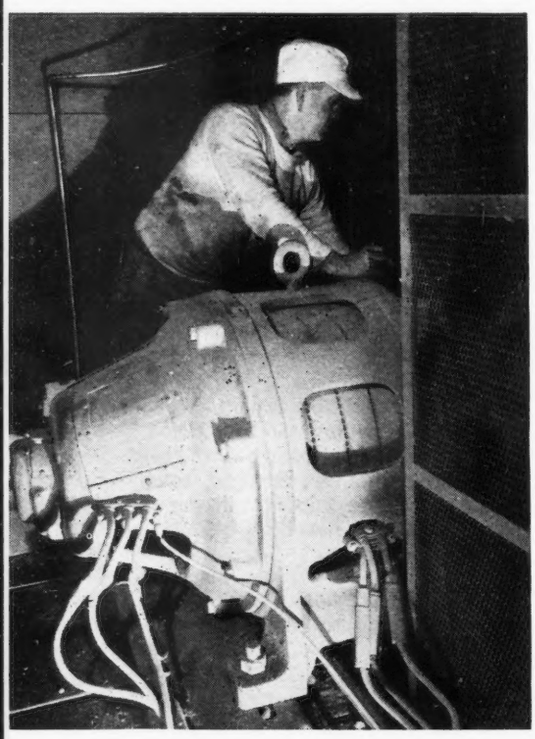
Realizing these conditions, however, the Government has made great efforts to obtain the services of competent men to advise in handling mining problems. It has a skilled and efficient mining and geological service in the Ministerio de Fomento under the guidance of S. E. Aguerrevere, of Stanford; Victor López, of Massachusetts Institute of Technology, and Manuel Tello, of the Ecole des Mines of France. Three years ago was founded the Institute of Geology, a well-equipped, four-year geological college on strictly modern American standards. And recently Carlos Delgado, who has had many years of experience in El Callao and is a graduate of the Colorado School of Mines, was appointed Director of Mines. It is probable that when these efforts bear fruit, the economic conditions that govern mining will greatly improve, in so far as the Government can alleviate them.

New Goldfields' El Peru mill, where the ore from all mines of the company is treated

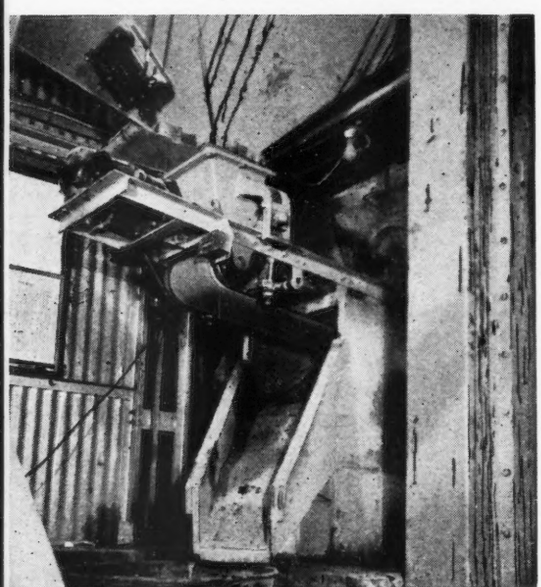




Stephens-Adamson apron feeder under crude-ore dump hopper driven by Allis-Chalmers 2-hp. motor mounted on top of a gear reducer



Largest motor of mill is this 125-hp. Westinghouse unit driving the crusher plant. M. E. Smith, chief electrician, checks temperature of bearing



Mounted on bottom of hopper bin (top, right), a V-125 Syntron vibrator keeps crushed ore gravitating to constant-weight feeder supplying ball mill

Some Electrical Aspects

Motors and drives selected give

J. H. Edwards
Electrical Editor

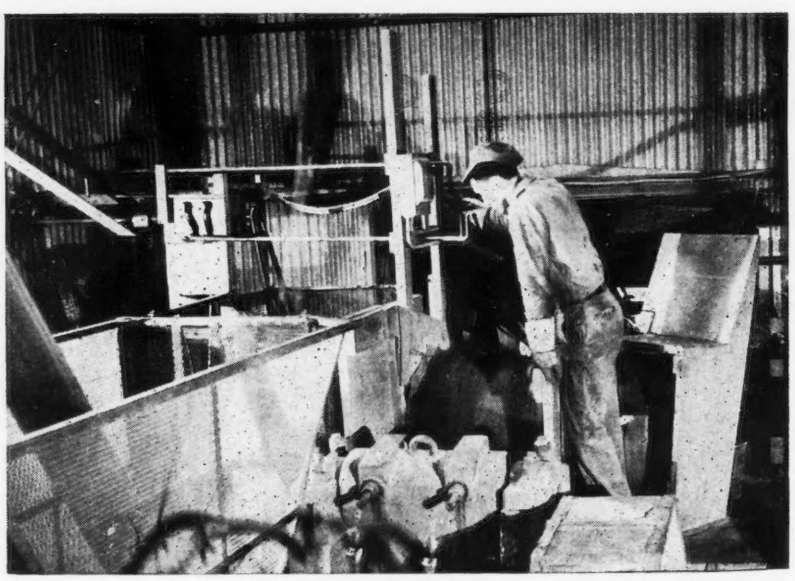
TWO HUNDRED electric motors constituting a connected load of close to 1,000 hp. drive the new mill of the Mahoning Mining Co., at Rosiclare, Ill., which treats a high-grade fluorspar-zinc-lead ore at the rate of 200 tons per day. Among the other equipment using electricity are a magnet for removing tramp iron and several magnetic vibrators on bins and feed hoppers. Motor-drive connections of the moderate-speed machines are V-belts and those on low-speed units are inclosed gear reducers, some of which are built onto the motors. Several Redler conveyor-elevators are used in handling dry materials.

The Mahoning company is a subsidiary of the Youngstown Sheet & Tube Co. J. G. Trewartha is superintendent. The fluorspar ore concentrated is mined from a blanket formation 18 miles from Rosiclare. It contains approximately 50 percent calcium fluoride, 13 percent zinc sulphide, and 4 percent lead sulphide. Separation of the three products is accomplished by flotation following grinding to minus 100 mesh. Because part of the fluorspar output is used for steel-furnace flux, and for that duty cannot be applied economically in the powder form, the mill includes a plant which compresses the fine material, with a binder, into pellets $\frac{1}{2}$ to $1\frac{1}{2}$ in. long and weighing about $\frac{1}{4}$ oz.

According to the maintenance records of Melvin E. Smith, chief electrician, the connected horsepower of 199 motors is 927.5. The largest motor is a 125-hp. 690-r.p.m. Westinghouse Type-CW, which drives crushing-plant equipment, including a belt conveyor bringing the crude ore from the truck-dump hopper, a Rogers (Joplin) 24x 24-in. jaw crusher, and a 3-ft. Symons cone crusher. Flat belts running from this motor to a countershaft and thence down to the units are the only flat belts used in the mill. Second largest is a General Electric 100-hp. Type-MT 865-r.p.m. driving a ball mill which operates in closed circuit with a Type-FX Dorr heavy-duty classifier. In this instance the motor connection consists of ten Gates V-flat belts. These two motors are the only ones of the mill which are of the wound-rotor type and which operate on 2,300 volts. All other motors take 220-volt a.c. power.

Principal motors of the mill are grouped in departments, as follows: There are 5 in the crushing plant, 81 in the flotation plant, 31 in the drying plant, 24 in the pelleting plant, 36 in the control laboratory, and 3 in the water-softening plant. As to numbers, the makes are represented as follows: Allis-Chalmers, 91; General Electric, 48; and Westinghouse, 18. The remaining motors, mostly small sizes, include ten other makes. Of the total connected

Two levers in front of man's face change gears of a Uni-drive four speed transmission in drive of belt conveyor which delivers crude ore to crusher



# of a New Fluorspar Plant

low maintenance and flexibility

load only 19 hp. is in the motors of fractional horsepower and these are in the 1/6- to 1/4-hp. range. Of the total, 53 are single-phase and 9 are three-phase.

Except for manual drum controls in combination with oil switches on the two largest motors, manual compensators on four 10-hp. and 15-hp. vacuum pumps, and a few motors with magnetic switches, the starters of the plant are manual safety switches. The magnetic switches are favored, however, and as changes become necessary that type will be added.

Six Syntron vibrators perform material-loosening duties throughout the plant. Two large V-125 units work on the main crushed ore bins. Of the remaining four Syntrons, all V-25 type, one is on the surge hopper to the ball mill, two are on hoppers in the pellet plant, and one is in use loosening pellets from the wire cloth of a continuous dryer.

Tramp iron is removed by a 30-in. circular magnet hung over a belt conveyor carrying oversize from a Ty-Rock screen to a Symons cone crusher. An electric eye is the control medium of a Hardimeter made by the Automatic Pump & Softener Corp., Rockford, Ill., which automatically checks the performance of a zeolite unit softening water for use in the flotation cells. The repair shop is equipped with a 300-amp. Lincoln Stable-Arc welder. Two electric Tellevels are mounted in the grinding-feed surge bin to manitain the material at close to constant level.

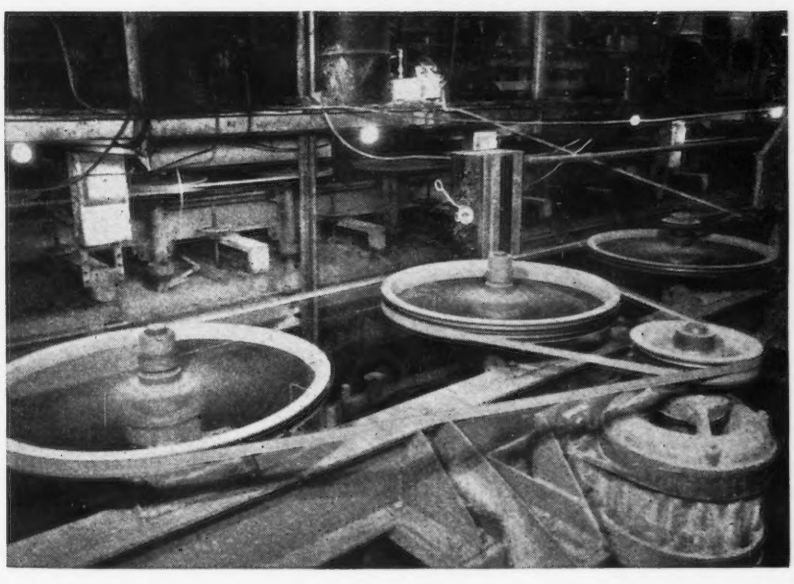
Practically all of the power and light wiring is installed in BX cable, the principal exception being in the wet places, where BXL (with lead sheath) is used. Transformers which reduce the 2,300-volt purchased power to 220 and 110 volts are mounted on a concrete platform beside the plant. The 220-volt three-phase power is furnished from six 50-kva. transformers. Single-phase 110-volt power for lighting and for 1/6- and 1/4-hp. motors comes from two transformers, one of which is 25-kva. and the other 37.5-kva.

The plant operates 24 hours per day and the monthly power consumption is 190,000 to 200,000 kw.-hr. Load factor, calculated from connected load (805 kw.) and total energy used during a month, is 34 percent. Based on 15-minute demand, the load factor is approximately 75 percent.

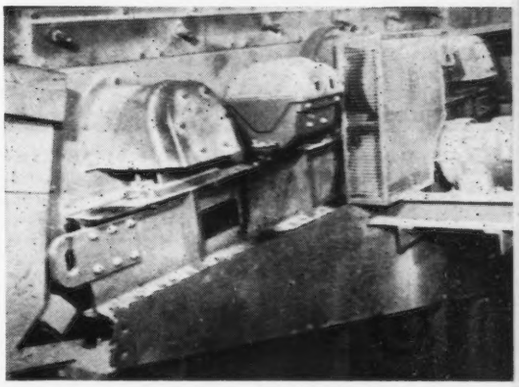
An indication of the high mechanical standards followed in building the mill is the fact that, counting 12 gear-motors that are in use, a total of 58 inclosed gear reducers are in service. The principal makes and the numbers of each in use are: Jones, 20; Stephens-Adamson, 8; Falk, 8; and Boston, 4.

Variable-ratio drives on several machines of the plant provide an exactness of speed change which facilitates operating adjustments. A Stephens-Adamson variable-speed transmission

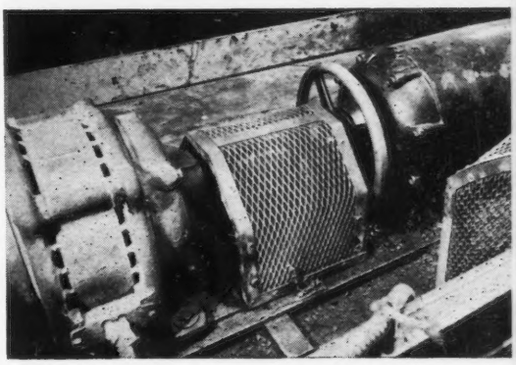
Vertical 10-hp. 860-r.p.m. Type-AR Allis-Chalmers motor and V-belts driving three flotation cells. One of 12 motors on similar duty



Allis-Chalmers Type-ART 7½-hp. motor with V-belt connection drives Ty-Rock double-deck vibrator in crushing plant of Mahoning company's plant

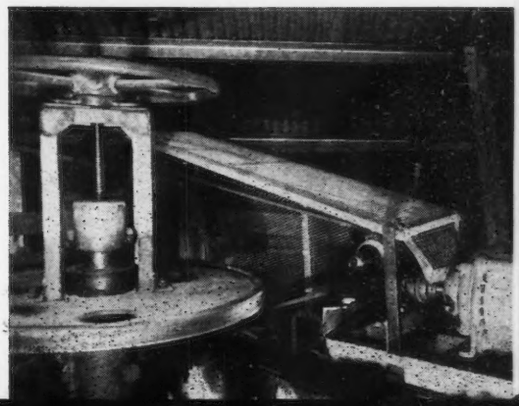


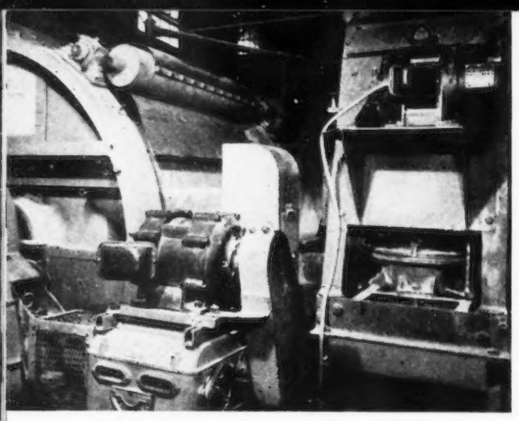
G. E. 5-hp. Type-KT motor and Stephens-Adamson variable-speed transmission driving 7-in. Redler conveyor handling ball-mill feed



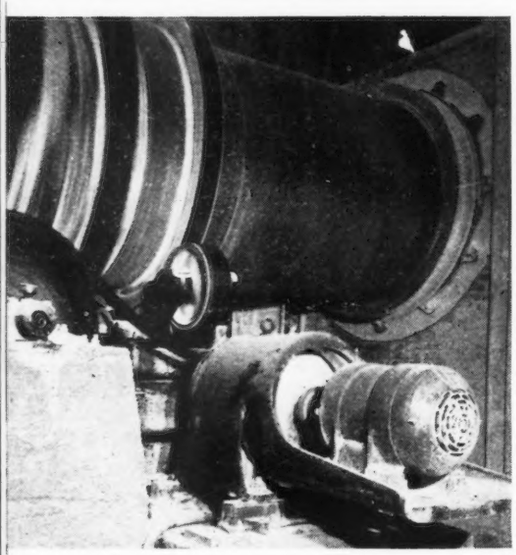
Second largest motor of plant is this 100-hp. Type-MT General Electric unit employed in driving Denver ball mill by multiple V-belts

A 26-ft. thickener is driven by this 1,150-r.p.m. G.E. motor working through a Jones 5-ratio worm gear reducer and V-flat belt

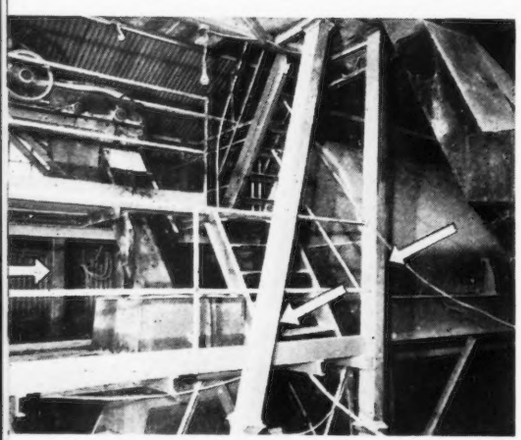




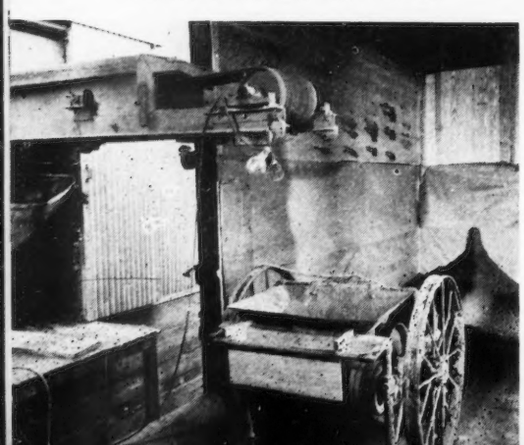
Allis-Chalmers motor in center is V-belted to Reeves variable-speed transmission on which it is mounted. Worm gear next to drum filter provides additional speed reduction. At upper right a 1,750-r.p.m. motor of same make, with Falk 7-ratio Motoreducer, drives a diaphragm pump



Allis-Chalmers 15-hp. 1,750-r.p.m. Type-ARZT fan-cooled motor, which, through Falk 41.5-ratio reducer, drives kiln, drying filtered fluorspar



Arrows point to Redler conveyor-elevators in fluorspar pelleting plant. Platform and railings are welded to conveyor tubes at right



between the driving motor and a 7-in. Redler conveyor-elevator from crushed ore bins to ball-mill surge hopper provides an output range of 11½ to 22 r.p.m. from the 3-hp. 1,165-r.p.m. General Electric Type-KT motor. In the drying plant the speed of a bin discharger is adjusted through a U. S. variable-Synchrogear.

A Reeves variable-speed transmission forms the center link in the drive of a Swenson drum-type filter. Mounted on top of the transmission and connected to it by V-belt is an Allis-Chalmers 1-hp. Type-ARK motor. A worm gear on the output shaft provides final speed reduction. In the photograph of this filter, at the right hand is a Denver diaphragm pump and its drive which delivers fluorspar concentrate to that filter. It is driven by an Allis-Chalmers Type-AR 1,750-r.p.m. motor, to the frame of which is attached a Falk ratio-7 Motoreducer.

In addition to the Redler conveyor-elevator handling crushed ore, three conveyor-elevators of that type are used in the drying plant to handle the dried fluorspar on its way to the pelleting rolls. Two of these Redlers are the 5-in. size and the third is a 3-in. unit. In some places in the plant the square tubular runs of these conveyor-elevators serve as supports for structures such as platforms and hand rails, which are welded to them.

A portable electric vacuum cleaner used three times per 24 hours affords a thorough and pleasant means of keeping the floors and ledges free of fluorspar and of recovering this dust. The cleaner is a Hoff-Man size-PC159 driven by a Westinghouse 1-hp. Type-CS 3,470-r.p.m. motor.

Another portable electric unit is a box-car loader used in loading the damp zinc concentrate into cars. This unit, wheeled to a position on the car floor to receive the discharge from a movable conveyor which is shuttled out of the building door and into the car, throws the concentrate by means of a high-speed belt. The drive is a General Electric 3-hp. Type-KT 1,730-r.p.m. motor.

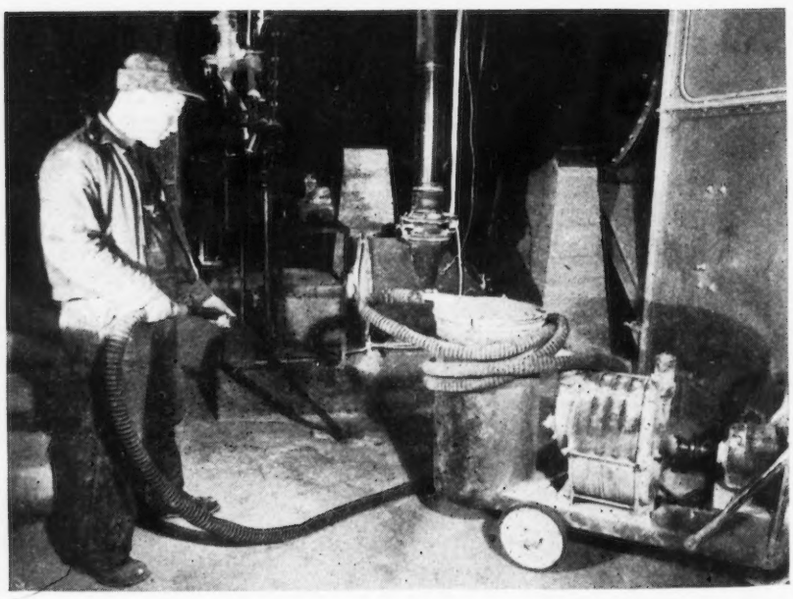
To facilitate electrical maintenance all motors are numbered and in the shop is a framed drawing of the mill buildings with the machines and numbers, and including an index to location. To systematize lubrication Robert K. Wisco, mill superintendent, has prepared a chart of all points of lubrication showing the quality and type of grease or oil considered best suited to each and including the particular type of Shell lubricant, the make now standard in the mill, that has the characteristics desired.

▼ ▼ ▼

Mine Warfare

MINE WARFARE is emphasized in a course on elements of mining which is being given for the first time by Pennsylvania State College. Forty-five students are enrolled. Engineer officers of the department of military science and tactics at the College are cooperating. Detection of enemy mining activity; explosives; approved safety practices for handling explosives; practice in using blasting accessories and preparing charges; demolition; construction; and removal of land mines are some of the topics covered.

Hoff-Man portable vacuum cleaner driven by 1½-hp. Westinghouse Type-CS 3,470-r.p.m. motor



Driving this throwing-type box-car loader is a 3-hp. General Electric Type-K 1730-r.p.m. motor

CURRENT METAL Statistics

AS THE FIRST QUARTER of 1942 comes to a close, output of base metals begins to climb. Quicksilver, however, appears to have reached a balance with consumption.

▶ ZINC — The domestic zinc statistics (all grades) for January and February, according to the American Zinc Institute, follow:

	Jan. 1942	Feb. 1942
Stock at beginning	24,062	23,925
Production	79,276	73,476
Total	103,338	97,401
Production daily rate	2,557	2,624
Shipments:		
Domestic	67,248	59,957
Foreign (drawback duty)	12,165	14,818
Total shipments	79,413	74,775
Unfilled orders	110,552	109,260
Stock at end	23,925	22,626

Production of Prime Western and other grades, follows:

Production by Grades		
Prime Western	30,396	26,616
Select	1,467	2,560
Brass Special	5,262	5,721
Intermediate	5,694	4,447
High Grade	19,934	19,427
Special High Grade	16,523	14,705
Total	79,276	73,476

▶ QUICKSILVER — Quicksilver production in the United States during December was 3,900 flasks, making a total of 44,000 flasks for 1941, the largest annual output since 1883, the Bureau of Mines reports.

Production of quicksilver in this country during the last five years, and annual average prices, in flasks of 76 lb. each, was as follows:

	Flasks	Average (a) Price
1937	16,508	$90.18
1938	17,991	75.47
1939	18,633	103.94
1940	37,777	176.87
1941	44,000	185.02

(a) New York (E&MJ averages).

▶ IRON ORE—Production of iron ore in the United States during 1941 was 92,499,000 gross tons, according to a preliminary estimate by the Bureau of Mines. Production in 1941 was the largest on record, surpassing the previous record year of 1917 by 23 percent.

Iron ore mined during 1940 and 1941, by districts, in gross tons:

	1940	(a) 1941
Lake Superior	61,471,323	79,130,000
Southeastern	7,440,650	7,951,000
Northeastern	3,559,924	3,975,000
Western States	1,224,002	1,443,000
Totals	73,695,899	92,499,000

(a) Preliminary.

▶ CHROMIUM — Chromium, already strictly controlled, has been placed under a complete allocations system by the Director of Industry Operations in an amendment to Order M-18-a. The amended order provides that no chromium may be melted except with specific authorization of the Director of Industry Operations. It is designed to prevent depletion of existing stocks, and to control further the flow of this important steel alloy.

The new regulations, together with Order M-21-a, which limits the uses of chrome steel, make use of the metal completely subject to the Director of Industry Operations.

▶ LEAD—Production of lead refined in the United States amounted to 53,385 tons during January, against 57,181 tons in December, according to the American Bureau of Metal Statistics. The statistics for December and January, in tons, follow:

	Dec.	Jan.
Stock at beginning	13,671	20,185
Production:		
From domestic ore	48,829	43,307
Secondary and foreign	8,353	10,078
Totals	57,181	53,385
Domestic shipments	50,680	53,037
Stock at end	20,185	20,531

Molybdenum Production in U. S.

Production of molybdenum concentrate in the United States during December amounted to 3,849,300 lb. of contained molybdenum, which compares with 3,758,200 lb. in November, according to the Bureau of Mines. Statistics of the industry, which includes smelter salts produced from complex ores, for November and December, in pounds of Mo, follow:

	November 1941	December 1941
Stocks at mines at beginning of month	18,603,000	17,902,600
Production during month	3,758,200	3,849,300
Shipped from mines during month:		
For domestic consumption	3,354,100	3,571,500
For export	1,104,500	1,072,500
Totals	4,458,600	4,644,000
Stocks at mines at end of month	17,902,600	17,107,900

United States Copper Statistics (Revised)

The following copper statistics, in tons, were released during February by Copper Institute. Figures on production and stocks cover duty-free metal, whereas deliveries, since March, 1941, include foreign copper imported by Metals Reserve Co.

	Production		Deliveries to Customers			(c) Stocks
	(a) Crude	Refined	(b) Domestic	Export	Totals	Refined
Year 1939	836,074	818,289	814,407	134,152	948,559	159,485
Year 1940	992,293	1,033,710	1,001,886	48,537	1,050,423	142,772
Year 1941	(d)1,016,996	1,065,667	(d)1,545,541	307	(d)1,545,848	75,764
1941						
January	83,280	93,840	119,736	22	119,758	116,854
February	79,240	93,654	112,808	11	112,819	97,689
March	85,701	95,322	134,333	6	134,339	89,873
April	88,042	89,687	123,580	49	123,629	98,789
May	90,342	89,390	(d) 148,301	.....	(d) 148,301	93,076
June	82,558	88,560	(d) 121,331	42	(d) 121,373	98,164
July	82,099	86,879	(d) 150,078	33	(d) 150,111	74,384
August	84,695	85,426	(d) 119,937	.....	(d) 119,937	71,930
September	81,839	81,553	(d) 125,585	.....	(d) 125,585	63,670
October	86,019	86,617	(d) 126,622	144	(d) 126,766	67,260
November	84,718	84,799	(d) 124,645	.....	(d) 124,645	72,352
December	(d) 88,463	89,940	(d) 138,585	.....	(d) 138,585	75,564
1942						
January	88,319	90,017	130,467	.....	130,467	81,371

(a) Mine or smelter production or shipments, and custom intake including scrap. (b) Beginning March, 1941, includes deliveries of duty-paid foreign copper for domestic consumption. (c) At refineries, etc., but not including consumers' stocks at their plants or warehouses. (d) Corrected.

U. S. Consumption of Primary Tin

(American Bureau of Metal Statistics)

In Long Tons

	Tinplate	Babbitt	Solder	Bronze	Tubes and foil	Other Uses (a)	Totals
1938	24,314	2,810	7,820	3,000	4,000	8,680	50,624
1939	38,321	3,760	10,090	3,960	3,910	9,000	69,041
1940	38,964	4,120	11,430	5,530	5,370	8,700	74,114
1941:							
Jan.	3,100	410	1,230	710	250	900	6,600
Feb.	3,100	430	1,230	700	300	900	6,660
Mar.	3,800	520	1,600	790	420	1,000	8,130
Apr.	4,000	710	1,460	770	450	1,000	8,390
May	4,200	620	1,810	800	430	1,000	8,860
June	3,700	570	1,410	800	420	1,000	7,900
July	4,300	620	1,440	800	400	1,000	8,560
Aug.	4,700	410	1,400	900	420	1,000	8,830
Sept.	4,200	440	1,870	900	420	1,000	8,830
Oct.	4,500	410	1,530	900	420	1,000	8,760
Nov.	4,300	370	1,320	900	400	1,000	8,290
Dec.	4,800	360	2,120	900	390	1,000	9,570
Totals	48,700	5,870	18,420	9,870	4,720	11,800	99,380

(a) Includes terne plate, pipe, white metal, alloys, castings, tinning copper sheet and wire, oxides and chlorides, and miscellanies.

Summary of the

MARKETS

THOUGH consumption of major non-ferrous metals is being restricted in so far as non-essential civilian products are concerned, war demands are increasing steadily and the supply situation shows no indication of easing. The second month of the year brought the long-expected price ceiling for quicksilver. As the month ended, the position of antimony was up for review. Because of higher ore quotations and other cost factors, producers of antimony claim that a higher price than 14c. a pound is needed to bring out necessary tonnages.

The *E.&M.J.* price index for February advanced to 85.90, which compares with 85.39 in January. The moderate uplift was occasioned by a higher monthly average for lead.

Late in February the War Production Board announced that aluminum output in the United States will be increased as fast as possible to the rate of 2,130,000,000 lb. a year. At the same time, it was stated that the magnesium program will be expanded to 725,000,000 lb. a year. Whether the growing output of the light metals will bring lower quotations is not known. During the last month, however, it was revealed that magnesium is selling on the basis of 22½c. a pound, carload lots. The previous published quotation was 27c.

The premium plan for extra-quota production of copper, lead, and zinc (see page 63) will not disturb the price level at which consumers will obtain those metals. Copper in the domestic market continued on the basis of 12c., Valley, and foreign metal was purchased by Metals Reserve at the equivalent of 11.75c., f.a.s. United States ports. Deliveries of copper to consumers during January totaled 130,467 tons, of which 46,357 tons was metal released by Metals Reserve. February deliveries of copper dropped under the average of recent months, but this was viewed as a temporary condition. The Copper and Zinc branches of WPB have been separated.

Formal ceiling prices were named for zinc, which clears some uncertainty about differentials on the various grades. Prime Western, under the ceiling, continued at 8.25c., East St. Louis; Selected, 8.35c.; Brass Special, 8.50c.; Intermediate, 8.75c.; High Grade, 9.25c.; Special High Grade, 9.25c.

Larger imports of lead than first thought possible relieved the situation in that metal during February. Producers are confident that output will rise under

UNITED STATES MARKET

1942	Electrolytic Copper — Domestic (a) Refinery	Electrolytic Copper — Export (b) Refinery	Straits Tin — New York	Lead — New York	Lead — St. Louis	Zinc — St. Louis
Feb.						
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
23	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
24	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR MONTH					
Feb.	11.775	11.700	52.000	6.50	6.35	8.25
Feb.	AVERAGES FOR WEEK					
4	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
Feb.	CALENDAR WEEK AVERAGES					
7	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25

SILVER, GOLD AND STERLING EXCHANGE

1942	Sterling Exchange — "Checks" (Nominal)	Sterling Exchange — "90-day demand"	Silver (c) — New York	Silver (c) — London	Gold — London	Gold (d) — United States
Feb.						
2	401.000	(f)	35.125	23.500	168s	$35.00
3	401.000	(f)	35.125	23.500	168s	35.00
4	401.000	(f)	35.125	23.500	168s	35.00
5	401.000	(f)	35.125	23.500	168s	35.00
6	401.000	(f)	35.125	23.500	168s	35.00
7	401.000	(f)	(e)	(e)	(e)	35.00
9	401.000	(f)	35.125	23.500	168s	35.00
10	401.000	(f)	35.125	23.500	168s	35.00
11	401.000	(f)	35.125	23.500	168s	35.00
12	Holiday	(f)	Holiday	23.500	168s	Holiday
13	401.000	(f)	35.125	23.500	168s	35.00
14	401.000	(f)	(e)	(e)	(e)	35.00
16	401.000	(f)	35.125	23.500	168s	35.00
17	401.000	(f)	35.125	23.500	168s	35.00
18	401.000	(f)	35.125	23.500	168s	35.00
19	401.000	(f)	35.125	23.500	168s	35.00
20	401.000	(f)	35.125	23.500	168s	35.00
21	401.000	(f)	(e)	(e)	(e)	35.00
23	Holiday	(f)	Holiday	23.500	168s	Holiday
24	401.000	(f)	35.125	23.500	168s	35.00
25	401.000	(f)	35.125	23.500	168s	35.00
26	401.000	(f)	35.125	23.500	168s	35.00
27	401.000	(f)	35.125	23.500	168s	35.00
28	401.000	(f)	(e)	(e)	(e)	35.00
	AVERAGES FOR MONTH					
Feb.	401.000	.....	35.125	23.500	....	35.00
Feb.	AVERAGES FOR WEEK					
4	401.000	.....	35.125	.....	....	.....
11	401.000	.....	35.125	.....	....	.....
18	401.000	.....	35.125	.....	....	.....
25	401.000	.....	35.125	.....	....	.....

Calendar week averages, New York Silver: Feb. 7th, 35.125; 14th, 35.125; 21st, 35.125; 28th, 35.125.
(e) Not quoted (Saturday). (f) No quotations.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. To arrive at the f.o.b. refinery quotations deduct .05c. from the f.a.s. basis for lighterage.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c. throughout February.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

the higher prices that are now in effect.

Price Schedule No. 93 was issued by OPA, effective Feb. 4, establishing a maximum on quicksilver of $191 per flask, f.o.b. point of shipment in California, Oregon, Washington, Idaho, Utah, Nevada, and Arizona; and $193 for Texas and Arkansas. On quicksilver imported from Mexico, the maximum set is $193, f.o.b. freight station in the United States nearest to point of entry, duty, if any, included.

The New York quotation for quicksilver is based on the f.o.b. shipping point price, Pacific Coast, plus freight and commission allowed under the order issued by OPA.

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LONDON TIN—Trading in Standard tin in London remained suspended throughout February.

OFFICIAL LONDON PRICES—COPPER, LEAD, ZINC

Following are the maximum prices of copper, lead, and zinc established by the Ministry of Supply for the British market, in effect since Dec. 18, 1939:

	Per £	Long Ton s.	d.
COPPER:			
Electrolytic, high conductivity	62	0	0
Fire refined, high conductivity	62	0	0
Fire refined, high grade	61	10	0
Fire refined, min. 99.7 percent	61	0	0
Fire refined, min. 99.2 percent	60	10	0
Hot rolled black wire rods	65	10	0
LEAD:			
Soft foreign, duty paid	25	0	0
Soft, Empire	25	0	0
English refined	26	10	0
ZINC:			
Foreign (G.o.b.), duty paid	25	15	0
Domestic (G.o.b.)	26	10	0
Prime Western and debased	26	10	0
Refined and electrolytic	27	5	0
Minimum 99.99 percent	28	15	0

Quotations are for metal delivered to the consumer.

E & M J PRICE INDEX

Weighted index of non-ferrous metal prices. The average for the years 1922-1923-1924 equals 100.

1929	110.33	1935	74.66
1930	82.87	1936	73.45
1931	60.20	1937	90.86
1932	48.26	1938	73.67
1933	59.79	1939	77.71
1934	69.59	1940	79.22
1941	83.49		

	1940	1941	1942
January	80.85	82.48	85.39
February	77.23	82.76	85.90
March	77.94	83.27	....
April	77.19	83.48	....
May	77.68	83.51	....
June	78.85	83.48	....
July	76.72	83.60	....
August	76.71	83.39	....
September	79.40	83.34	....
October	82.49	83.84	....
November	83.14	84.32	....
December	82.42	84.42	....

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(March 2, 1942)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c
Antimony, domestic, spot, lb	14.00c
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	22½c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$197.05
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry, 48%	
Cr_2O_3, 2.8 to 1 ratio	$30.00
Domestic, 48%, 2.5 to 1 ratio (f.o.b. mines)	$40.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.75
Manganese Ore, (foreign) c.i.f. U.S. ports, long ton unit of Mn:	
50 per cent	66c.
48 per cent	65c.
46 per cent	63½c.
Manganese Ore, domestic, 48%, f.o.b. mines, l.t. unit	75c.
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a)$26.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.15
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.43
Sodium Sulphate, bulk, ton	$18.00@$24.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$120.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 percent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton;	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$49.50
Shorts	$13@$17.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$57.00@$60.00
Paper stock	$40.00@$48.00
Shorts	$13.00@$26.00
Floats	$18.00
Barytes, long ton:	
Georgia, crude	$8.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$6.50
Bauxite, long ton:	
Domestic, crude, 50 @ 52 percent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$25.00
Ground, 95 @ 98 percent, bulk, ton	$34.00
Lump, acid, 98 percent, bulk, ton	$32.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	45@65c.
2 x 2 in.	60@85c.
3 x 3 in.	$1.85@$2.05
3 x 4 in.	$2.15@$2.25
3 x 5 in.	$2.50@$2.75
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.50@$10.50
Vermont, extra white, 200 mesh	$9.50@$10.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$23.50
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1941	1942	1941	1942	1941	1942
January	34.750	35.125	23.273	23.500	(a) 402.000	(a) 401.000
February	34.750	35.125	23.341	23.500	(a) 401.864	(a) 401.000
March	34.750	.....	23.446	.....	(a) 401.788	.....
April	34.750	.....	23.500	.....	(a) 401.058	.....
May	34.750	.....	23.457	.....	(a) 400.981	.....
June	34.750	.....	23.400	.....	(a) 401.000	.....
July	34.750	.....	23.397	.....	(a) 401.000	.....
August	34.750	.....	23.459	.....	(a) 401.000	.....
September	34.750	.....	23.500	.....	(a) 401.000	.....
October	34.750	.....	23.500	.....	(a) 401.000	.....
November	34.772	.....	23.500	.....	(a) 401.000	.....
December	35.125	.....	23.500	.....	(a) 401.000	.....
Year	34.783	.....	23.439	.....	(a) 401.224	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine. London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents. (a) Nominal.

COPPER

	F.O.B. Refinery, Electrolytic			
	Domestic		Export	
	1941	1942	1941	1942
January	11.819	11.775	10.257	11.508
February	11.794	11.775	10.414	11.700
March	11.814	.....	10.592	.....
April	11.820	.....	10.952	.....
May	11.815	.....	10.950	.....
June	11.810	.....	10.950	.....
July	11.812	.....	10.950	.....
August	11.778	.....	10.950	.....
September	11.775	.....	11.027	.....
October	11.775	.....	11.367	.....
November	11.775	.....	11.200	.....
December	11.775	.....	11.200	.....
Year	11.797	.....	10.901	.....

New York quotations, cents per pound.

LEAD

	New York		St. Louis	
	1941	1942	1941	1942
January	5.500	6.275	5.350	6.125
February	5.602	6.500	5.452	6.350
March	5.765	.....	5.613	.....
April	5.850	.....	5.700	.....
May	5.850	.....	5.700	.....
June	5.850	.....	5.700	.....
July	5.850	.....	5.700	.....
August	5.850	.....	5.700	.....
September	5.850	.....	5.700	.....
October	5.850	.....	5.700	.....
November	5.850	.....	5.700	.....
December	5.850	.....	5.700	.....
Year	5.793	.....	5.643	.....

New York and St. Louis quotations, cents per pound.

TIN

	Straits, New York		Standard, Spot, London	
	1941	1942	1941	1942
January	50.154	52.000	256.648	(b)
February	51.293	52.000	264.975	(b)
March	52.067	.....	270.131	.....
April	51.981	.....	269.775	.....
May	52.166	.....	267.534	.....
June	52.685	.....	262.750	.....
July	53.481	.....	258.272	.....
August	52.385	.....	257.013	.....
September	52.000	.....	256.364	.....
October	52.000	.....	255.842	.....
November	52.000	.....	256.713	.....
December	52.000	.....	(a) 257.625	.....
Year	52.018	.....	261.137	.....

New York quotations, cents per pound. London, pounds sterling per long ton. Average of 6 days. Quotations suspended Dec. 9. (b) Not quoted.

ZINC

	St. Louis			
	1939	1940	1941	1942
January	4.500	5.644	7.250	8.250
February	4.500	5.534	7.250	8.250
March	4.500	5.750	7.250	.....
April	4.500	5.750	7.250	.....
May	4.500	5.803	7.250	.....
June	4.500	6.235	7.250	.....
July	4.516	6.250	7.250	.....
August	4.719	6.389	7.250	.....
September	6.104	6.920	7.250	.....
October	6.500	7.250	7.942	.....
November	6.500	7.250	8.250	.....
December	5.980	7.250	8.250	.....
Year	5.110	6.335	7.474	.....

St. Louis quotations, Prime Western, cents per pound.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1941 (a)	1942 (a)	1941	1942
January	80.000	90.000	17.000	15.000
February	82.273	90.000	17.000	15.000
March	89.038	.....	17.000	.....
April	90.000	.....	17.000	.....
May	90.000	.....	17.000	.....
June	90.000	.....	17.000	.....
July	90.000	.....	17.000	.....
August	90.000	.....	17.000	.....
September	90.000	.....	17.000	.....
October	90.000	.....	15.000	.....
November	90.000	.....	15.000	.....
December	90.000	.....	15.000	.....
Year	88.443	.....	16.500	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound. (a) Producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1941	1942	1941	1942	1941	1942
January	14.000	14.000	165.846	202.519	36.000	36.000
February	14.000	14.000	170.182	197.272	36.000	36.000
March	14.000	.....	177.692	.....	36.000	.....
April	14.000	.....	180.077	.....	36.000	.....
May	14.000	.....	180.000	.....	36.000	.....
June	14.000	.....	183.920	.....	36.000	.....
July	14.000	.....	188.577	.....	36.000	.....
August	14.000	.....	192.000	.....	36.000	.....
September	14.000	.....	192.440	.....	36.000	.....
October	14.000	.....	193.615	.....	36.000	.....
November	14.000	.....	196.273	.....	36.000	.....
December	14.000	.....	199.654	.....	36.000	.....
Year	14.000	.....	185.023	.....	36.000	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk f.o.b. Laredo, Tex., 13.000 for February. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum, per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1941	1942	1941	1942	1941	1942
January	24.50	24.50	23.50	23.50	24.00	24.00
February	24.50	24.50	23.50	23.50	24.00	24.00
March	24.50	.....	23.50	.....	24.00	.....
April	24.50	.....	23.50	.....	24.00	.....
May	24.50	.....	23.50	.....	24.00	.....
June	24.50	.....	23.50	.....	24.00	.....
July	24.50	.....	23.50	.....	24.00	.....
August	24.50	.....	23.50	.....	24.00	.....
September	24.50	.....	23.50	.....	24.00	.....
October	24.50	.....	23.50	.....	24.00	.....
November	24.50	.....	23.50	.....	24.00	.....
December	24.50	.....	23.50	.....	24.00	.....
Year	24.50	.....	23.50	.....	24.00	.....

Iron, dollars per long ton. F.o.b. Mahoning and Chenango Valley furnaces.

Premium Price Plan for Copper, Lead, and Zinc

Rules and regulations prescribed by which mine operators in the United States may obtain premium prices for over-quota production

CONFUSION over the method to be adopted in administering the premium price plan for copper, lead, and zinc was removed on Feb. 9 by an official announcement of procedure by William L. Batt, director of materials, WPB, and Leon Henderson, administrator, OPA. The principal rules and regulations are as follows:

1. The premium price plan is one of the steps taken to increase production. In accordance with this plan, the Metals Reserve Co. has announced that it will pay, for a period of 2½ years beginning Feb. 1, 1942, and ending July 31, 1944, premium prices for the production of copper, lead, and zinc in excess of quotas to be established jointly by WPB and OPA. These premium prices will be based on 17c. for copper, 11c. for zinc, and 9¼c. for lead.

2. The premium price plan went into operation Feb. 1, 1942. Regardless of the time at which tonnage quotas are announced and regardless of the time at which actual payments under the plan begin, premium payments shall be made for all over-quota production in February and subsequent months.

3. A joint committee from the War Production Board and the Office of Price Administration shall fix initial quotas.

4. Quotas shall be established for particular mines or groups of mines herein referred to as a "property," and shall be expressed in terms of a property's monthly rate of production. A property's production shall be included in determining its quota and over-quota production regardless of whether that production is converted into metals, metal oxides, or other products.

5. There shall be five distinct classes of quotas: (A) Zero quotas. (B) Intermediate. (C) 100 percent quotas. (D) Special quotas between zero and 100 percent. (E) Special quotas in excess of 100 percent.

(A) Zero Quotas—Any property which had (1) no production or (2) production during 1941 of 200 tons or less of any metal, shall have a zero quota for such metal, except as provided in (E) below.

(B) Intermediate Quotas Between Zero and 100 Percent Quotas—Any property, except as provided in (E) below, which during 1941 produced more than 200 tons but less than 600 tons of any metal, shall have a quota for such metal based upon a figure obtained by deducting 200 tons from the 1941 output of such metal, and multiplying the remainder by 1½. The resultant figure shall be divided by 12 to arrive at the property's monthly quota.

(C) 100 Percent Quota—Any property, except as provided in (D) and (E) below, which during 1941, produced more than 600 tons of any metal, shall have a quota for such metal equal to the property's 1941 rate of production of that metal. A property's 1941 rate of production of any metal shall be determined by dividing its production of that metal for the year by the number of weeks during which the property was in operation, multiplying the resultant figure by 52 in order to translate a partial year's production into a yearly rate, and dividing by 12 in order to arrive at a monthly rate to be used for quota purposes.

(D) Special Quotas Less Than 100 Percent—In special cases a property may be assigned a quota less than 100 percent of its 1941 monthly rate of production.

(E) Special Quotas in Excess of 100 Percent—In the case of certain properties, special quotas higher than 1941 production will be established, based upon the tonnages which can be reasonably be expected to be produced from such properties at the established ceiling price for each metal—i.e., 12c. for copper, 8.25c. for zinc, and 6.50c for lead. Likewise, persons and companies which did not operate certain mining properties during 1941 but had plants under way to operate them may be assigned quotas on such properties higher than zero. All those for whose properties such special quotas are being considered have already been notified.

6. Should any property fail to maintain its quota production in any month or months, premium payments will not be made until the accumulated deficit is made up by over-quota production in subsequent months. Material deficits due to major calamities such as floods or fires will not be so accumulated. If conditions develop which make it impossible for the quota production of a property to be maintained, the government will consider applications for reduction of the quota. However, the government reserves the right to restore any initial quota which has been reduced.

7. All initial quotas, once established, shall not be raised during the period of operation of the plan.

8. The Metals Reserve Co. has informed WPB and OPA that in the case of a company with two or more properties, should the production of any property show a material decrease below its quota, the owning or operating company will be required to account for the decrease. If, after a hearing, it shall appear to the Metals Reserve Co. that such decrease was due to avoidable circumstances, the existing quotas of all properties of the company will be combined into one quota. In this event, premium prices for metals produced by such a company will be paid only to the extent that total production exceeds the total company quota.

9. If the ownership or leasehold rights with respect to any property which does not have a zero quota are transferred during the period of operation of the plan, the quotas of both buyer and seller must be reviewed before the buyer or seller makes any claim for the payment of premium prices.

10. With respect to concentrator tailings produced prior to Feb. 1, 1942, each mill or treatment plant treating only such tailings shall be considered as a separate property entitled to a quota based on tonnage not in excess of its 1941 rate of metal production, arrived at in accordance with the formula for determining the rate of mine production as stated in 5 (C) above.

Metal and products recovered from tailings produced after Feb. 1, 1942, shall not be paid for at premium prices.

Special arrangements will be made for those cases in which tailings produced prior to Feb. 1, 1942, are being treated in a mill which also treats mine ore, and for those cases in which differences in ownership complicate quota determination.

11. Special arrangements may also be made for production from slags, residues, and other waste products from smelters.

12. Production from mine waste dumps will be considered as production from the mine or group of mines from which the dump originated.

13. Premium payments will be based upon metal paid for under the terms of settlement contracts. Quotas, of course, will be fixed on the same basis. If no settlement contracts exist, quotas and premium payments will be computed on the basis of 95 percent, 90 percent, and 85 percent of the metal content in the case of copper, lead, and zinc, respectively. Ores from mines from integrated companies will be treated in the same manner.

14. All inquiries concerning the application of the premium price plan to particular properties should be directed to the Copper, or Zinc, or Lead Branch of the War Production Board.

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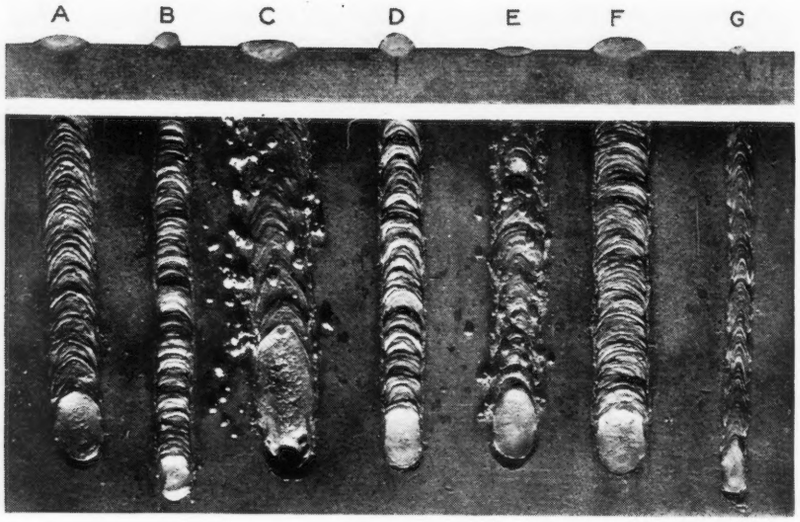
Chromium Control Extended

Chromium, already strictly controlled, has been placed under a complete allocations system by the Director of Industry Operations in an amendment to Order M-18-a. The amended order provides that no chromium may be melted except with specific authorization of the Director of Industry Operations. It is designed to prevent depletion of existing stocks, and to control further the flow of this important steel alloy.

USEFUL OPERATING IDEAS



Characteristics of welds provide a good check on electrode conservation. Compare welds shown in illustration with data given in respective columns of accompanying table. Note what happens to electrode burn-off rate, weld penetration, appearance of welds, and arc sound when the three factors of arc current, arc volts, and arc speed are varied from "normal."

Conservation of Welding Electrode Coupled With Best Use

IN ORDER that welding may contribute its utmost potentiality in war production, it is important that welding materials be utilized to maximum advantage, writes Clayton B. Herrick, welding engineer, the Lincoln Electric Co., Cleveland, Ohio. This applies particularly to welding electrodes. It is the electrode which provides the metal of proper physical properties and operating characteristics, permitting production of highest-quality welds in minimum time and at minimum cost.

A number of factors affects the most efficient use of electrodes. If conscientiously controlled, these factors will contribute to best use of welding.

1. Select the right type of joint and be careful of fit-up. There is a type of joint best suited to the particular job. A serious waste of weld metal results by using a complicated joint where the more simple type of connection will suffice. Joints and their fit-up should be given most careful consideration.

2. Choose the correct type of electrode. The electrode should be chosen with respect to: (a) physical properties required; (b) type of joint; (c) position of welding—that is, flat, vertical, overhead or horizontal; and (d) condition of fit-up of the work.

3. Use an electrode which has and maintains a uniform coating. The coating not only produces the protecting shield but also controls (1) fluidity of the metal; (2) penetrations; (3) shape of the beads; (4) physical properties of the deposits; and (5) composition of the deposit.

4. Use electrodes which provide proper physical properties. Required physical properties of the work at hand should be known and the electrode should be selected to meet these requirements.

5. Use fast-flowing electrodes wherever possible.

6. Select an electrode which keeps splatter and slag loss at a minimum. Since all splatter is a waste of weld metal, the importanee of this is obvious.

7. Wherever possible use electrodes which produce flat beads. To deposit more metal than required is a waste of welding electrode.

8. Select the right-size electrode. The one having the largest diameter which can be used effectively is best from the standpoint of conservation.

9. Use long electrodes in the larger size. The obvious result is the reduction in the number of stub ends and in the time saved by eliminating interruptions to change rods.

10. Do not bend electrodes. This generally unnecessary habit will waste from a quarter to a third of the electrode.

11. Use proper voltage and current settings. If current is too high or too low, it will manifest itself either in excessive splatter loss or inferior welds having improper fusion and penetration.

12. Follow the procedure specified for the electrode. These specifications have been prepared carefully by the manufacturers and, if followed consistently, will prevent waste of electrode and assure high-quality welding.

13. Avoid using an excessive num-

Characteristics of Welds Seen in Accompanying Photo When the Factors of Arc Current, Arc Volts, and Arc Speed Are Varied From "Normal"

	F	A	B	C	D	E	G
Arc current	Normal	Low	High	Normal	Normal	Normal	Normal
Arc volts	Normal	Normal	Normal	Low	High	Normal	Normal
Arc speed	Normal	Normal	Normal	Normal	Normal	Low	High
Burn-off of electrode	Normal appearance, coating burns evenly	Practically same as preceding	Coating is consumed at irregular high rate. Watch carefully	Coating too close to crater. Touches molten metal resulting in porosity	Drops at end of electrode flutter and then drops into crater	Normal	Normal
Penetration Fusion (Crater)	Fairly deep and well defined	Not very deep nor well defined	Deep, long crater	Small	Wide and rather deep	Crater normal	Small, rather well defined crater
Appearance of bead	Excellent fusion — no overlap	On top of plate Not as much overlap as with bare rod	Broad, thin bead Good fusion	High bead, not as pronounced as for low amps., somewhat broader	Wide spattered	Wide bead — overlap large. Base metal and bead excessively heated	Small bead — undercut — reduction in bead size and undercutting depends on speed and amperes
Arc sound	Sputtering hiss plus sharp crackling	Irregular sputtering. Some crackling	Regular explosive sounds	Hiss plus steady sputter	Soft sound plus hiss and few crackles	Normal	Normal

ber of beads. If one bead of weld metal will meet design requirements, it is obviously a waste of electrode to add additional beads.

14. Use electrode down to minimum stub end. Remember that the electrode can be used the entire length of its coated surface. Leaving any more than a minimum stub end is an obvious waste.

15. Collect and save stub ends of electrode. The average stub end is 2 in. long and this length multiplied by the millions of electrodes used would constitute a great loss.

16. Use a modern high-capacity welding generator. A modern 40-volt generator was shown to produce 7.7 in. of joint per electrode, as against 6.6 in. for an older machine.

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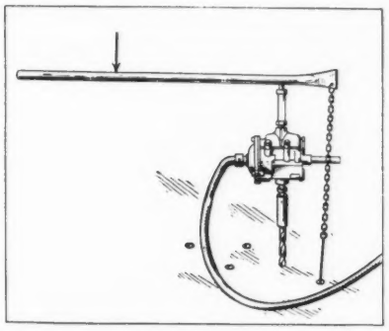
Lever Speeds Use Of Electric Drill

A SIMPLE LEVER made from a 6-ft. section of 2-in. pipe, enables two men to make rapid progress in countersinking holes for



rivet heads in a large sheet of heavy steel, writes Joseph C. Coyle, of Yuma, Ariz. One end of the pipe is flattened, and a hole is drilled through it in order to attach a chain with a section of small rod suspended from it. The rod is bent at right angles on the end, and is used to anchor the lever by slipping through a hole in the sheet near the one to be reamed, and hooking it against the bottom side of the plate. To prevent the lever from slipping off the head of the electric drill, a small hole is drilled in the pipe about 18 in. from the point at which the chain is attached. The hole may be reamed a little to make it fit on top of the electric drill. Moving the device is but a moment's work.

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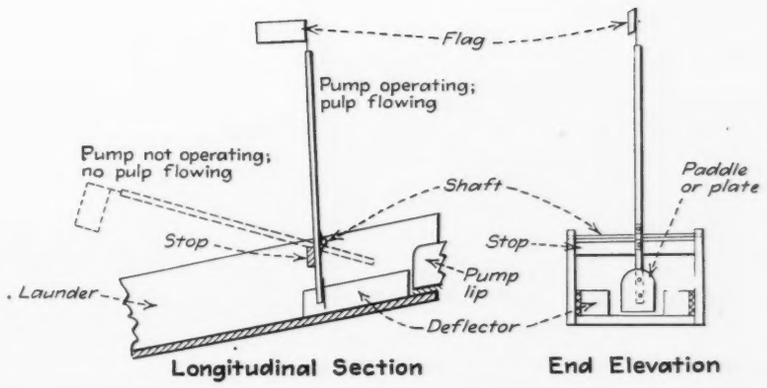
Pump Indicator

THE DEVICE was developed at the plant of Mill Tails Recovery Co., Colorado Springs, Colo., which was re-treating old tailings of the Portland mill by countercurrent decantation. The tailings were cyanided directly and it was inevitable that refuse found its way into the circuit. As a result, the diaphragm pump's check valves were frequently hung up, reducing or stopping the thickener underflow. The tailings were coarse, with little slimes, and even a short interruption would result in plugged pipes.



To eliminate the consequent need for patrolling the thickeners, a simple, reliable, and conspicuous indicator was devised and installed immediately below the discharge lip of each pump. This enabled the men to check the pumps at a glance from any point in the mill. The indicator was constructed as follows:

A piece of wood $\frac{1}{2}$x$\frac{1}{2}$ in. in cross-section and 4 ft. long was fastened to a shaft of $\frac{3}{8}$-in. thick round steel placed across the launder a foot from the pump. The shaft was free to rotate in holes bored through the sides of the launder about an inch below the top. The bottom of the stick or indicator extended below the shaft to within an inch of the launder bottom and to it was fastened a 2x3-in. galvanized-iron plate. This plate was exposed to the force of the pump stream, which was concentrated on it by two deflectors made of 1x2x12-in. pieces of wood set in the bottom of the launder in the shape of an open "V," the top being placed at the pump lip. Thus, the indicator would be held upright by the pulp stream, being forced against a 1x2-in. stop nailed across the launder just below the shaft and far enough forward so that the indicator could not quite come to a vertical position but would lean slightly backwards; the idea being that, should the flow of pulp stop, the indicator, relieved of the pressure on the plate which held it upright, would immediately fall over backwards. To make the device more conspicuous a flag was fastened to its top.

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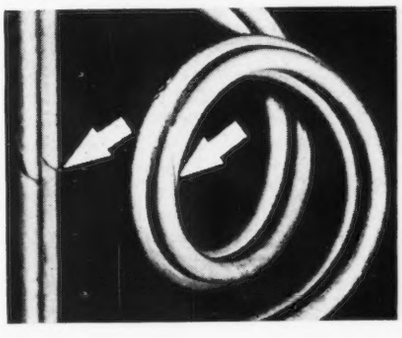
Trolley Cable Repair

LOW-TEMPERATURE silver-alloy brazing has been found satisfactory for joining two pieces of copper trolley cable, according to an announcement by Handy & Harman. The ends to be joined are cut diagonally with a hacksaw, and then butted together and held firmly in place with a suitable jig. The surfaces to be joined are brushed with Handy Flux, a low-temperature brazing flux which is active at 1,100 deg. F. Heating is done by oxyacetylene torch, which brings the joint up to brazing temperature rapidly. A silver brazing alloy, Easy-Flo, flowing at 1,175 deg. F., is touched to the heated parts as soon as they show a dull cherry-red heat and penetrates instantly throughout the joint. This operation takes only five minutes and provides a connection which electrically is as efficient as a continuous cable. The strength of the braze also is as high as, or higher than, the strength of the solid wire.



As a joint of this type is free from internal oxidation, the need for cleaning or other maintenance is eliminated. The gases for heating and the brazing alloy for the job cost only 5c. for each complete braze.

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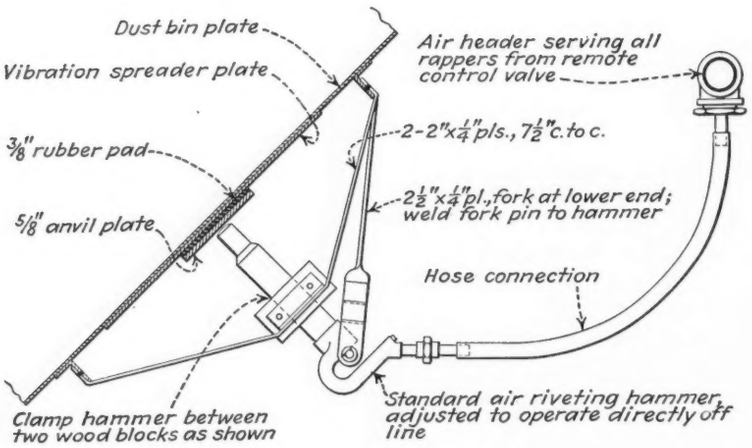
Dust-Bin Rapper

UNDER the dust-bin collector of the Cottrell plant at Chile Exploration Co. reduction works at Chuquicamata, Chile, are mounted compressed-air riveting hammers to


Dust bin plate
Vibration spreader plate
3/8" rubber pad
5/8" anvil plate
Air header serving all rappers from remote control valve
2-2"x1/4" pls., 7 1/2" c. to c.
2 1/2"x1/4" pl., fork at lower end; weld fork pin to hammer
Hose connection
Standard air riveting hammer adjusted to operate directly off line
Clamp hammer between two wood blocks as shown

rap down the sloping sides of the bin. The simple apparatus consists of air-operated riveting hammers adjusted to operate directly from the air header and mounted in the flexible cradle shown in the accompanying sketch.

The hammer strikes an anvil plate 10x10x$\frac{5}{8}$ in. thick, under which is mounted a cushion of used conveyor belting. This in turn is overlaid by a vibration spreader plate 32x32x$\frac{5}{16}$ in. thick riveted to the dust-bin plate. A remote-control valve efficiently operates ten of these mechanical rappers under the Cottrell bins, writes Elwood Stockman.

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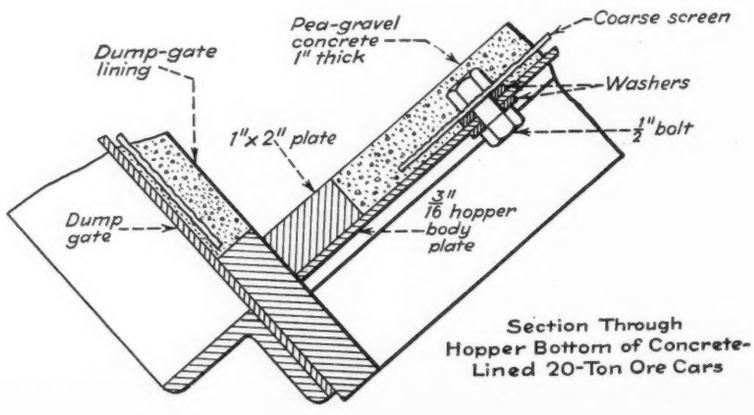
Concrete Lining for Ore Cars

IN VIEW of current limitations on the use of steel, and the urgent need to conserve steel for war purposes, a description of a concrete lining for ore cars in use at the plant of the Britannia Mining & Smelting Co. may be of interest, writes A. C. Munro, general superintendent of mills, Britannia Beach, B. C.

Heretofore the 20-ton hopper-bottom ore cars on the haulage system to the mill have been lined with $\frac{3}{8}$-in. steel plate. By way of experiment one car was lined with concrete to a thickness of 1 in. It has now been in service, handling ore crushed to 6 in., for more than five months with no indication of cracks in the concrete and only a slight wearing effect through abrasion. The life of this lining will be several times that of steel, and wear from rust is not a factor as it is with the steel lining. As lining renewals become necessary the steel plates are being replaced by the concrete lining.

The bottom of these cars is of 3/16-in. steel plate, sloped at 40 deg., with an air-operated dump gate at the foot of the hopper. The 3/16-in. plate bottom is drilled to take $\frac{1}{2}$-in. bolts, and sections of discarded coarse screens from the mill crushing plant are bolted to the bottom, with a space under the screen of about 3/16 in. A section of 1x2-in. steel bar is bolted across the bottom of the hopper to take the closing impact of the dump gate, and the hopper is then lined with concrete made up of pea gravel and a 50-50 mixture of sand and cement sufficient only to fill the voids in the gravel. This concrete is then poured over the screen and tamped to 1-in. thickness, as illustrated in the accompanying sketch, and finished by trowelling to a smooth surface.

Where heavy plate linings are used, a substantial saving may be made in the dead weight of the cars when the steel plate is replaced by the concrete.



Section Through Hopper Bottom of Concrete-Lined 20-Ton Ore Cars

It may also be of interest to record the fact that similar concrete linings of various thicknesses, both precast and poured in place, are used extensively and to good advantage in replacing rubber and steel linings in the launders throughout the crushing and milling plants.

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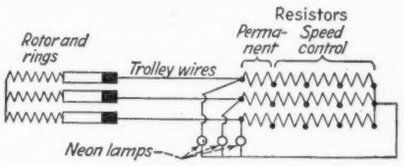
Telltale for Motor Connections

FREQUENTLY a bad or broken connection in the secondary circuit of a polyphase slip-ring motor will result in serious overheating and damage before the maintenance man is aware of that trouble, writes E. C. Bohm, chief electrician, Metal & Thermit Corp., South San Francisco.

This company's motors have permanent resistors in the rotor circuits, and under heavy-duty cycles these resistors are particularly likely to develop defects. To give them a constant check on the secondary circuits of our crane motors, the company installed three 2-watt Neon glow lamps in the manner illustrated.

With the circuit shown, a poor or



broken connection in the resistors causes the lamp to glow longer than the others during the motor acceleration period. If there is a poor or broken connection in the rotor or wiring circuit, one light remains out during motor acceleration. Thus, the electrician needs but to glance at the Neon lamp (mounted so as to be readily seen from the floor) while the crane is operating, to be able to forestall the greater damage to the electrical equipment which would result from continued operation of a defective rotor or resistor.

Five Dollars for an "Idea"

SHORTAGE OF EQUIPMENT in the present emergency puts a premium on the ingenuity of master mechanics and electricians to keep mining and milling machinery running. If you have done an interesting job, just sketch or photograph it and send it in with a brief description. *E.&M.J.* **will pay $5 for acceptable items.**

PERSONAL ITEMS

A POSITION IS OPEN on the editorial staff of Engineering and Mining Journal. Correspondence is invited from mining engineers with technical training and experience, and with some facility in the use of the English language. Complete personal details, including salary level and selective service status, should be submitted with letter of application. Address the editor for further information.

OEM photo

Donald M. Nelson (right), chairman of the War Production Board, and Paul Wooton, Washington representative of *Engineering and Mining Journal* and President of the National Conference of Business Paper Editors, at the Conversion Conference with WPB officials in Washington, Feb. 13, 1942

Harry C. Chellson, associate editor of *Engineering and Mining Journal*, who has been on the staff since 1935, has resigned to become editor of *Mining Congress Journal*.

Ralph Neyman, of Osburn, has been named underground superintendent of the Hecla and Star mines. Coeur d'Alene district.

F. H. Cash, of Hibbing, Minn., has been appointed general manager of iron-ore properties for the Lake Superior district for Republic Steel Corp.

General D. M. Hogarth was elected president of the Steep Rock Iron Mines, Ltd., on Feb. 17, succeeding the late Joseph Errington.

Prof. William H. Emmons, of the University of Minnesota, was on Feb. 10 awarded the Penrose Medal by the Society of Economic Geologists, "in recognition of his outstanding contributions to the science of economic geology."

Charles J. Stakel has been appointed assistant manager of the Cleveland-Cliffs Iron Co. mines in the Lake Superior district. He is filling a new executive position created to provide assistance to **S. R. Elliott,** manager. **Arthur Olson,** electrician for the Negaunee district for the same company, has been made chief electrician for the Marquette range.

Fred Searls, Jr., vice president of the Newmont Mining Co., has been appointed to the Planning Board of the War Production Board by Chairman Donald M. Nelson.

H. W. Haldane, until recently superintendent for the United States Vanadium Corp. at Uravan, Colo., has been promoted to be assistant general superintendent, with headquarters at the company's offices at 30 East 42d St., New York City. **H. H. Coleman** has succeeded Mr. Haldane at Uravan.

Byron G. Best, mining engineer with the Oliver Iron Mining Co., has been transferred from Ironwood, Mich., to Duluth, to assume the post of supervisor of safety in the company's industrial relations department.

Harry O. King, of New York, has been appointed chief of the copper branch of the division of materials of the War Production Board, Washington, D. C.

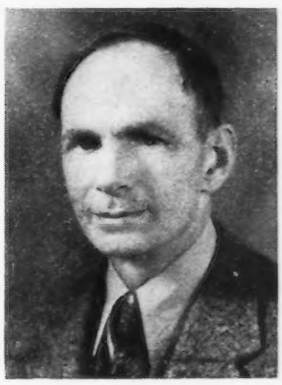
HARRY O. KING

Mr. King replaces H. W. Dodge, who has been acting as chief for the past month. Mr. Dodge will resume his regular position as a special assistant to A. I. Henderson, deputy director of the division. Mr. King is an officer of a number of corporations and is president of the Munson Lines, Inc. He was division administrator of the NRA and was director of the Copper Code Authority.

Hugh R. Van Wagenen has been appointed consulting engineer to the lead-zinc section of the Office of Price Administration in Washington, where he will make his headquarters.

Eugene H. Dawson, consulting mining engineer, New York, for many years engaged in the investigation of mining ventures and mineral deposits in Alaska, South America, Europe, India, and Northern Africa, was recently appointed assistant chief of the mica-graphite branch of the materials division of the War Production Board, Washington, D. C.

E. C. Nighman, international mining expert and formerly acting assistant to Dr. R. R. Sayers, Director of the U. S. Bureau of Mines, has been appointed chief of the Explosives Control Division



E. C. NIGHMAN

of the Bureau of Mines. He will have charge of the administration of the Federal Explosives Act.

Harry J. Wolf, consulting mining and metallurgical engineer, New York, until recently consultant on cadmium of the

copper-zinc-cadmium branch, Office of Production Management, has been appointed principal technical consultant of the mica-graphite branch and will continue chief of the cadmium section of the materials division, War Production Board, Washington, D. C.

Edward C. Bradley, contractor of Iron Mountain, Mich., has brought to attention the fact that the Bradley open-pit iron mine at Iron Mountain should have been included in the list of Menominee Range iron mines operating in 1941, that appeared in the article "Mining on the

EDWARD C. BRADLEY

Menominee" in the January issue. In this article it was stated that the only operating pit on that range during 1941 was the mine of the Globe Iron Co. The Bradley mine is under lease to the Jackson Iron & Steel Co., of Jackson, Ohio. A brief description of the operation is given on page 82 of the current issue.

Walter S. Weeks writes that in his article "The Evasse on a Centrifugal Exhaust Fan," appearing in the January issue, an error was made in drawing the illustrative "fan total" curves in Figs. 4 and 5. These curves should not drop to zero pressure at full opening, as may be seen from an actual "fan total" curve in Fig. 1. The exposition is unaffected by this error.

Dr. C. F. Rassweiler, who joined the Johns-Manville Corporation last June as director of research, has been appointed a vice president of the company, as announced by **Lewis H. Brown,** president. In his new office, Dr. Rassweiler will continue in charge of the company's research and development activities which are now largely devoted to converting the full production capacity of Johns-Manville to war uses.

George W. Strahan, of International Nickel Co., Inc., heads a special advisory committee of metallurgists designated the War Products Advisory Committee, recently formed by the New York Chapter of the American Society of Metals. The committee will assist small or large metal-producing or metal-working manufacturers engaged in war production and will function without compensation and without charge. Inquiries should clear through Mr. Strahan, by mail to the ASM War Products Advisory Committee, 18th floor, 67 Wall St., or by telephone to Whitehall 4-1000.

OBITUARY

Robert S. Merriam, veteran mining engineer of the Coeur d'Alene district, died on Jan. 25 last. He was 63.

A. M. Conard, a veteran mining operator of Arizona and Mexico, died at Magdalena, Sonora, Mexico, on Feb. 8. He was 77.

Manuel Rocha, 54, auditor of the Credito Minero y Mercantil, S. A., the pioneer Mexican mining industry financing bank, died at his home in Mexico City on Jan. 24.

Dr. Arthur Robert Andrew, mining engineer and geologist, director of the Otago School of Mines, University of Otago, at Dunedin, N.i., New Zealand, died on Dec. 14 last at Dunedin, at the age of 61.

John A. Fitzpatrick, since 1900 interested in gold and silver mining in the West, and formerly connected with Santa Rosalia Mining Co., in Mexico, and Utah Gold Mining Co., died in Philadelphia on Jan. 8 last at the age of 76.

Ing. Raoul Garnier, technical engineer for Productores de Mica Mexicana, producers and distributors of mica with headquarters at Tacuba, 13, Mexico City, died at Oaxaca de Juarez, Oaxaca, on Jan. 18. He was 57.

George H. Dormer, superintendent of the Marquette district, in northern Michigan, since 1932, for the Oliver Iron Mining Co., died on Jan. 25 at Rochester, Minn., at the age of 67. He had been associated with the company since 1895.

H. V. Croll, former general sales manager and Western district manager for Traylor Engineering & Manufacturing Co., died on Jan. 27 at the age of 73. Mr. Croll was an outstanding copper-smelting engineer prior to his association with the Traylor enterprise.

Jesse Fuller McDonald, a mining and political leader in Colorado for more than 40 years, and who become Governor of the State in 1905, though not elected to that office (he succeeded to the Governorship by virtue of his election as Lieutenant Governor after the successful candidate for Governor had resigned after a contest), died on Feb. 25 at the age of 83. Governor McDonald was presi- of the Colorado Mining Association for many years, retiring in 1942. He was closely identified with mining development in Leadville.

Ralph C. Nowland died in Oakland, Calif., Feb. 5, 1942. Mr. Nowland was for a number of years connected with the exploration department of the Utah Copper Co. in San Francisco. He was at Ray, Ariz., in 1910, and in 1914 joined the exploration department. A wide circle of friends in the mining fraternity held Nowland in high esteem. He was a native of Kansas City, Mo., a graduate of Purdue University, and a veteran of the Spanish-American War.

Joseph Errington, 77, a prominent and colorful figure in Canadian mining circles for many years, as pioneer, prospector, and corporation official, and who had been identified with practically every type of mining activity and production in the Dominion, died of coronary thrombosis while en route to New York to attend the recent annual convention of the A.I.M.E. He was a member of the Canadian Institute of Mining and Metallurgy, of the A.I.M.E., and of other scientific and professional associations.

Dalton Beverly Pittman, superintendent of the Santa Ana Unit of Cia. de Real del Monte y Pachuca, Pachuca, Hidalgo, Mexico, was accidentally electrocuted in the mine on Dec. 5, 1941. In 1932 Mr. Pittman joined the staff of the Real del Monte company, as safety and ventilation engineer. In 1934 he was made assistant superintendent of the La Rica Unit and in 1936 was advanced to the position of superintendent of the Santa Ana Unit.

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LETTERS

Valuation of Future Profits

C. E. MILLS' article in the November issue on "Valuation of Future Profits" is interesting and instructive, but one might wish that he had gone a little further.

While we give Mr. Mills credit for meticulous accuracy, it is to be noted that his valuation figure, $35,222.58, differs from that which he reaches by the Hoskold tables by only 3.7 percent. In a matter such as valuation, in which so many factors can be only estimated, and that within rather wide limits, is this not akin to "pacing the diameter of a circle and calculating its circumference to the fourth decimal point?" It recalls a mine report I saw not long ago in which the engineer estimated developed ore as 349,999 tons.

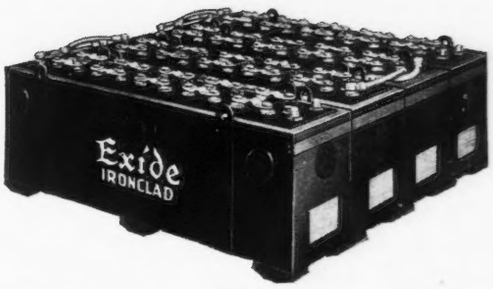
Who, for example, would venture to predict for the next ten years the price of any metal or costs of wages or supplies within 4 percent? Well do I remember advancing very specious arguments in 1928 to a client as to why we had reason to expect copper to maintain at least a 15c. price for some time to come. Came 1932, and was my face red!

Or who, ten years ago, would have thought of valuing a gold mine on any basis other than $20.67, the price that had obtained for a hundred years, or possibly $20 per ounce? I think that if we average profits over a term of years we shall find ourselves, in the main, within the allowable limit of error.

However, there is another phase to this valuation business that might well have attention. I think it is customary, in estimating increment to the sinking fund, to assume compound interest at savings bank rates. When Hoskold and Inwood, whom Hoover cites, were published, 4 percent was a common figure for this and 3 percent was considered conservative. At present 1½ and 1 percent are more in keeping with actual experience and we find the above tables outmoded. T. M. Putnam in his "Mathematical Theory of Finance" gives two useful formulas for use in connection with the valuation of a wasting asset.

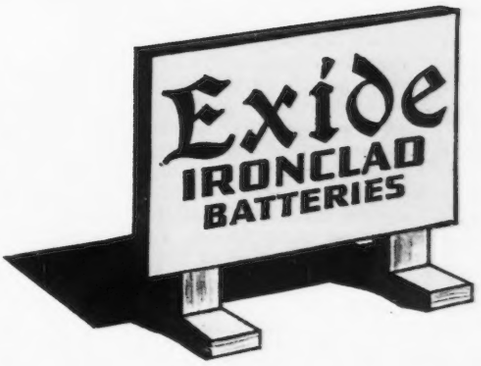
Considering first the difference in com-

... and Exide steps up the pace



No *safe* degree of speed can be too great when a nation arms for total war. Every mine and open pit must push production at maximum pace.

In mines, quarries and open pits in all parts of America, Exide-Ironclad Batteries power storage battery locomotives, trammers and shuttlecars to speed the flow of vital minerals and ores. Underground, more Exides are used than all other makes of batteries combined. Underground, as everywhere, Exide helps *Keep America Rolling.*



THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

pound interest at 1½ and 3 percent. Referring to the first item in Mr. Mills' example we find that at 3 per cent the unit figure is 1.305. At 1½ per cent it is 1.175, 10 percent less, which is going to make quite a difference in the amount necessary to put into the sinking fund, and consequently the remainder which will be available for dividends. Incidentally, on the subject of dividends is not 6 percent rather a low rate for a business in which the unexpected has such an unpleasant way of happening? One large company that I know will not take on a new venture unless it can see 18 percent.

Let us consider Putnam's formulas and start by assuming that we find it is going to take $50,000 to acquire and equip a property and develop it for ten years operation. What then is the amount that must go annually into the sinking fund at 1½ percent compound interest to retire the investment in ten years?

D=Annual payment to sinking fund.
V=Value based on cost as above.
N=Life in years.
i=Interest on sinking fund.

$$s_{\overline{n}|} = \frac{(1+i)^n - 1}{i}$$

$$D = \frac{V}{s_{\overline{n}|}}$$

In the above hypothetical case

$$s_{\overline{n}|} = \frac{(1+0.015)^{10}-1}{0.015} = \frac{1.167-1}{0.015} = 11.133$$

$$D = \frac{50{,}000}{11.133} = \$4492$$

In a year when the total profit was $8,000 the amount available for dividends would be $3,508 or 7 percent on the investment.

Putnam's formula for valuation is

$$V = \frac{R}{\frac{1}{s_{\overline{n}|}} + i'}$$ in which

V=Value of property—to be computed.
R=Annual income.
i'=Investment rate.
i=Interest on sinking fund.
$S_n/$=As above.

Present-day methods, however, have to some extent supplanted the above discussed tables and formulas. Now obsolescence, depreciation, depletion, amortization, etc., take the place of the sinking fund calculation and give a figure that is absolutely net profit and can be used as a basis of setting up valuation.

Berkeley, Calif. LEROY A. PALMER

The Editor:

I APPRECIATE Mr. Palmer's comments on valuation, particularly with reference to my article on "Valuation of Future Profits With Variable Annual Income" in the November 1941 number of *Engineering and Mining Journal.*

Engineers who have had any experience with valuation of mines either for sale or for tax purposes realize the difficulty of predicting future metal prices, and that any variations in anticipated metal prices change the final figures to a much greater extent than minor differences in ore reserves, predicted production costs, risk rates or methods of discounting future profits to present date.

My intent on the presentation on the above article was for clarification to engineers who use Hoskold's discount factors rather than any discussion on the ramifications of the methods and variable factors entering into valuation of mines or other producing properties.

For instance the State had sent in two engineers to this property for valuation for State tax purposes at the time the open pit was operating and when variable income made an appreciable difference in their final figures. Both engineers split the life of the mine into two operating periods and were at a loss how to discount the expected operating profits back to present worth. Another instance was the Comptroller of the United Verde Copper Co., who in 1926 did considerable work in valuation of this property for depletion tax purposes and although a brilliant accountant, did not know how to discount variable income to present worth.

Undoubtedly in large properties with fully developed orebodies, particularly with open-pit mines where there is no danger of loss of ore by subsidence or mine fires, or difficulty in estimating probable ore, the return on the investment may be at a much lower rate of interest than on small underground operations where the risk of recovering the capital investment is much greater. With higher labor costs, the present tax set-up, group insurance, and employee annuity programs, I believe the large mining companies will do well to realize 6 percent return on their investments.

Jerome, Ariz. C. E. MILLS

The Editor:

IN YOUR NOVEMBER ISSUE appeared an article titled "Valuation of Future Profits With Variable Annual Income," written by C. E. Mills. In the tables illustrating Mr. Mills' methods I have noted a few errors which may bear acknowledgment. The first, apparently typographical, occurs in the third line of column B. The compound interest factor for the third year should be 1.229874, instead of 1.1229874, as printed. For the seventh year, the product of columns A and B, or the sum allotted to the sinking fund, should be $3,327.82 — 0.06655636V. This correction, when reflected in the total sums of column AxB, sets up the equation

59,499.47 — 0.68882548V = V;
or 59,499.47 = 1.68882548V. The corrected present value is, therefore, $35,-231.27 and the corrected discount factors equals 0.704625 instead of 0.704452.

Mr. Mills' method is a contribution to the field of mine valuation, but, in my opinion, his method should not be considered as having more utility than Hoskold's unless the variable annual income can be predicted accurately during the future life of the mine. Of course, Hoskold's formula and factors, based on uniform annual profits, do not take into account the fluctuations in net income common to mining operations. But, unless appreciable variations in such income can be certainly predicted, an engineer engaged in mine valuation should hesitate to profess a greater degree of accuracy in his calculations, which are necessarily based on estimates, than is practically possible. In general, the engineer would probably find more justification for stating that net income for each year during the life of the mine will approximate $5,000 than in affirming specifically that such income will be $7,000 during the third year and $3,000 during the seventh year. With the method described, the present value cannot be determined unless the degree of the variable income can be predicted. Careful consideration for all the factors involved may enable the engineer to find other applications than valuation in retrospect—that is, determining the value of the mine as it was ten years ago.

Mr. Mills' choice of an illustration may not have been entirely unfortunate, but it does present opportunity for interesting speculation. His problem is this: At the end of the ninth year, he is pledged to pay 6 percent interest, or $2,113.88, out of a net income of $2,000, and deposit the rest (and it might be appropriate to ask "What rest?") to draw interest at 3 percent for one year. Fortunately, having made the eighth yearly deposit to surplus one year ago, there is no need for further deposit to build up accumulating surplus. In fact, the account has been over-deposited. But, there still remains the problem of paying a full 6 percent to our investors at the end of this ninth year. To pay this full 6 percent, Mr. Mills cannot draw the additional $113.88 from the bank, for these deposits must remain deposited until the end of the tenth year so that they will appreciate at 3 percent return the original investment. Indeed, to accomplish the latter and to pay eventually the investors their 6 percent, he must skip his ninth year interest payment, deposit the $2,000 in the bank so that it may earn an additional $60 (at 3 percent) by the end of the tenth and last year) and then he may declare a 12 percent final dividend, besides returning the accumulated capital. I decided to give up when I began to consider whether Mr. Mills still owed the investors interest on the interest payment he postponed for one year.

Admittedly, this problem is entirely theoretical, for Mr. Mills would probably save himself all this trouble by giving the entire income to the investors the end of each year and letting them reinvest the proper portion at the desired 3 percent, so that they would at the end of ten years have received all their initial capital and an average 6 percent interest.

El Portal, Calif. A. C. HARDING

Stenographer's Lament

The Editor:

INCLOSED PLEASE FIND a "Stenographer's Lament," which I found attached to 33 pages of petrographical descriptions accompanying one of my reports on a gold mine:

"You can have your Scheelite, Petzite,
Uralite and Leucoxene—
"Dolomite, Sericite,
Phenocrysts and Pyroxene—
"Your Tremolites, Plagioclases,
Sphalerites and HOW—
"But after 32 pages, I can diorite now?"

It might be of interest to you and some of the readers of *Engineering and Mining Journal* to visualize the excruciating pains he must have suffered while copying these technical descriptions.

WILBUR H. GRANT

San Francisco, Calif.

News OF THE INDUSTRY

A.I.M.E. Annual Meeting Stresses "Ores, Metals, and the War"

BROUGHT TOGETHER by the desire to speed the industry's important work in winning the war, more than 2,000 members of the American Institute of Mining and Metallurgical Engineers convened in the 156th meeting of the Institute, held on Feb. 9-12 in New York City. Attendance was larger than generally expected because of the war, and members in military uniforms accented the gravity of the times.

The first meeting on Sunday, Feb. 8, directed by the Mineral Industry Education Division, discussed a paper presented by T. T. Read, Vinton Professor of Mining Engineering, Columbia University School of Mines, entitled "How Mining Companies Should Recruit Engineers." The plan of having an "All-Institute" luncheon on the first registration day, Feb. 9, again proved successful. As last year it was held at the Commodore Hotel and gave members a good opportunity to meet friends and hear an outstanding speaker on some of the problems of war production. Right Honorable Lord Marley, member of the House of Lords, 1930-1941, and formerly Under Secretary for War, was the speaker, and his subject, "British Unity for War Production," left no doubt in the minds of his listeners that British unity and determination to win the war withstood an acid test during the heavy bombings on the British Isles. Lord Marley said: "We are no longer property-conscious in England today. All we are concerned with is to win the war. We don't mind having nothing left if we win the war." He said that a person earning $1,000,000 in England today must pay $975,000 of it in taxes, as against around $693,000 for a similar income in this country. He pointed out that full productive capacity had not been attained in Britain, although last June it had reached about 75 percent. Time lost in the industrial centers due to air raids has been small. As an example, only four and a half hours of work time was lost in Manchester despite 120 air raids. He described some legislative steps demanded by both employers and labor to remove the necessity of strikes, which he pointed out are relatively few in number in England, and last only a few hours.

Student prize awards were presented at the "All-Institute" luncheon by Dr. Lewis E. Young, vice president of the Institute. The awards of the Board of Judges were as follows:

For papers by undergraduate Student Associates:

A prize of $100 cash for a paper entitled "A Metallurgical Study of Cast Irons Used for Glass Molds," by Harry Czyzewski, University of Illinois, entered by the Chicago Section.

A prize of $100 cash for a paper entitled "Some Aspects of the Mining Methods Employed at the Scrub Oak Mines of the Alan Wood Steel Company," by Mayo W. Lanning, Lafayette College, entered by Lehigh Valley Section.

A prize of $100 cash for a paper entitled "Relationships of Manganese Minerals in the Butte District," by Charles F. Parent, Montana School of Mines, entered by Montana Section.

For papers by graduate Student Associates:

A first prize of $100 cash for a paper entitled "Surface Protection of Steels by the Use of Cast Iron Borings," by David L. Ellis, University of Wisconsin, entered by the Chicago Section.

A second prize of $50 cash for a paper entitled "The Wisconsin Road Material Survey," by Thomas Walker, Washington University, entered by St. Louis Section.

Various technical sessions at Institute headquarters following the luncheon were devoted to milling methods, geophysics, education, industrial minerals, and mining geology. Monday evening members gathered at alumni meetings, followed by the dinner-smoker at the Waldorf-Astoria Hotel, where entertainment artistic and otherwise similar to that of past smokers was furnished.

Use of diesel locomotives underground was the subject discussed on Tuesday morning at a joint session of the Coal Division and Mining Methods Committee, with Lewis E. Young and Philip B. Bucky as chairmen. The general thought at this meeting seemed to be that diesel locomotive for use underground are satisfactory provided proper ventilation is maintained. Papers presented were "Operating of Diesel Locomotives Underground," by Fred W. Stiefel, chief engineer, Samuel R. Roseff, Ltd.; "Diesel Engines in Tunneling Operations," W. B. Harris, Leonard Greenburg, and Gustave Werner, of N. Y. State Department of Labor; "Use of Diesel Locomotives in Tunnels," by S. H. Ash, supervising engineer U. S. Bureau of Mines, Wilkes-Barre, Pa., and L. L. Maus, engineer-in-charge, Bureau of Mines, Albany, N. Y. Jay A. Carpenter, director Mackay School of Mines, Nevada, discussed "State Mining Laws Relating to the Use of Diesel Equipment Underground."

The general session on Tuesday after-

This gathering of authorities on metals participated in the forum on "Ores, Metals and War" during the recent convention of the A.I.M.E.: From left to right are Z. Jefferies, National Academy of Sciences; Andrew Leith, technical consultant of WPB; John A. Church, WPB consultant on copper; P. D. Wilson, WPB consultant on magnesium; D. H. Wallace, assistant director of the price division of OPA; P. Linz, mineral authority of OPA; H. D. Smith, of Metals Reserve Corp.; C. F. Jackson, of the Federal Bureau of Mines; G. W. Roddewig, OPA zinc and cadmium unit head; and Gilbert Seil, of the National Academy of Sciences.

Eugene E. McAuliffe, president in 1942 of the A.I.M.E., speaks to members of the Institute. Mr. McAuliffe is president of the Union Pacific Coal Co., Omaha, Neb. On the right is John R. Suman, president of the Institute during 1941.

▸ A. I. M. E.

noon devoted to "Ores, Metals, and the War" reflected the theme of the convention, and, being well presented and attended, it was regarded as the most important meeting held. The meeting was opened by chairman, Wilfred Sykes, and Clyde Williams, as vice chairman. R. E. McConnell, chairman Engineers Defense Board, presented a paper, "Comparative Metal Supplies in 1942 of the United Nations and the Axis Powers." He said "America's capacity for producing metals and minerals is about three times that of Germany, but it is dangerous for anyone to take comfort from this. The United States is 4,000 miles from the front, and Germany 1,000 miles. The real measure of capacity will be in tonmiles, because of the work, the men, and the risks it will require to transport each ton of ore production to the firing line." He said we are short 1,000,000 engineers and technically trained men needed to maintain our armed forces. He also urged engineers to express themselves and their views to the government in aiding war effort.

"Elements of a Materials Conservation Program" was presented at this meeting by Zay Jeffries, Advisory Committee on Metals and Minerals, National Academy of Sciences. He urged mine operators to be careful and conserve existing equipment as much as possible and to maintain a balanced inventory. Wilfred Sykes, president of the Inland Steel Co., asserted that great domestic steel making capacity is on the way, estimated to reach a peak in 1944, when about 98,000,000 tons will be produced, or about twice that of the rest of the world combined.

Donald H. Wallace, Assistant Director, Price Division, OPA, discussed "Prices as a Factor in Metals Supply." He said that in a war economy the factor of prices cannot be comparable to times of peace, as price by itself in war time cannot be a positive determining factor to influence greater production. If prices were permitted to rise there would develop a trend in all industry of holding back production, waiting until still higher prices would come about, thereby bringing on the vicious spiral of inflation. Therefore, he said, the Government would gladly buy newly mined metal at determined premium prices such as 17c. Valley for copper, and sell at the ceiling prices of 12c. copper 5c. below the premium price in order to help prevent inflation.

John A. Church, consultant to WPB, discussing "Copper and Zinc—How to Expand Production," said it is not easy to say how to increase output of metals rapidly as the problems involve many factors. He pointed out three ways possible: by RFC loans for new production, by reclamation and a review of the position of the leasor, and by conservation.

Andrew Leith, technical consultant to WPB, talked about "Manganese and Chrome—Two Vital Ferro-Alloying Materials," and Philip D. Wilson, technical consultant to the WPB, discussed the importance of "Magnesium—Increasing the Output 60-Fold."

The second part of the meeting was devoted to questions, including: (a) Those asked by members of the audience; and (b) a number prepared and submitted in advance to one of the experts for study. The Panel of Experts included the seven who presented papers and, in addition, the following:

A. L. Fairley, Materials Division, WPB; Paul Linz, Office of Price Administration; H. DeWitt Smith, Metals Reserve Co.; H. K. Masters, Materials Division, WPB; George W. Roddewig, Office of Price Administration; Charles F. Jackson, U. S. Bureau of Mines; Gilbert Seil, Advisory Committee on Metals and Materials, N.A.S.; Charles H. Herty, Jr., Advisory Committee on Metals and Minerals, N.A.S.; Enoch Perkins, Advisory Committee on Metals and Minerals; N.A.S.; Frank Ayer, Materials Division, WPB.

Sessions on Wednesday were devoted to Mining Methods, Industrial Minerals, Non-ferrous Metallurgy, and Health and Safety in Mines. The annual banquet was held at the Waldorf-Astoria, where medals and honors were presented and Eugene E. McAuliffe, president of the Union Pacific Coal Co., was introduced as president of the Institute for 1942. The James Douglas Medal was awarded to Arthur S. Dwight "for his contributions to the art of smelting non-ferrous ores; and particularly for his pioneer work in developing equipment and technique for sintering such ores and metallurgical products." The Robert W. Hunt Award for 1942 was presented to Harold K. Work for his paper, contributed to the Institute, entitled "Photo-cell Control for Bessemer Steelmaking."

The principal speaker of the evening was Max W. Ball, president Abasand Oils, Ltd., Canada, who spoke on "Anglo-American Responsibilities."

Mining Congress Meets In Annual Session

THE FORTY-FOURTH annual meeting of the American Mining Congress was held in the Statler Hotel, Cleveland, Ohio, Feb. 6, 1942. The usual reports of officers and committees were presented and recorded. John Martin, assistant to J. W. Knowlson, Director of Industry Operatons, War Production Board, spoke on the objectives of WPB, with particular reference to the mineral industry. He emphasized the necessity for maximum production and explained that mining and processing companies will be given every assistance in obtaining the machinery and supplies required in their work.

The following officers were elected for the ensuing year: President, Howard I. Young; first president, D. D. Moffatt; second vice president, D. A. Callahan; third vice president, J. D. Francis; Secretary, J. D. Conover. Directors: D. A. Callahan, L. S. Cates, C. H. Crane, J. D. Francis, H. C. Jackson, W. J. Jenkins. The Executive Committee comprises Howard I. Young, W. J. Jenkins, and D. D. Moffatt.

The Resolutions Committee held its proposals to a minimum, emphasizing the primary need of production. A brief statement follows:

"The American Mining Congress assembled at Cleveland, Ohio, upon the sixth day of February, 1942, pledges its complete cooperation to the task of carrying the war to a successful conclusion.

"Minerals are of such vital necessity that we urge full recognition by management, labor, and stockholders of the responsibility which each must accept in order that maximum production be obtained.

"New and high-cost mineral production must be encouraged. The Government has assumed responsibility for the methods by which this shall be done. The mining industry, whatever its views as to the effectiveness of the methods, will assist to the fullest extent.

"Production for war needs is of first

importance. To this end the mining industry reaffirms its position on the necessity of equitable employee-employer relationship, sound fiscal policies, the elimination of non-essential Government expenditures, and other matters which are essential to the successful prosecution of the war and the preservation of our American way of life.

"The mining industry pledges itself to work and produce for Victory."

CALIFORNIA

Prospecting for Strategic Minerals Increasing

Chrome and manganese deposits in Butte County being investigated—Rainfall brings relief to placer operators

▶ Local interest continues to increase in strategic minerals, chrome and manganese. Miners in Butte County have asked for a Government assay office and the establishment of a stockpile in Butte County, where activity in prospecting for these minerals is increasing. In Trinity County the break-up of the winter is expected greatly to increase activity in chrome and manganese districts.

▶ A good snow pack and abundant rains have encouraged placer and hydraulic mines to resume operations. The Relief Hill hydraulic mine is in operation (C. E. Clark, superintendent), as is also the Omega, east of Washington. Howland Flat, La Porte, and Port Wine are also reported in operation. At Forest Hill preparations for drift mining are being made.

▶ K. I. Fulton, director of the State Department of Mineral Resources, commented recently on priority ratings and stated that of some 1,000 mine operators, whose names were submitted by the State Coordinator of Mining Priorities to OPM, to date 314 have received priority permit numbers carrying the A8 rating. The small number is due to the policy of WPB restricting permits to operators having ten or more men at work, making exceptions only where strategic minerals are being produced.

▶ A mercury price horizon of $191 per flask has apparently been accepted by Western producers without much apparent protest. Though the market price of about $200 or more per flask ruled at the time for spot metal, some producers who were selling mercury on the basis of time contracts did not receive this price and may now benefit by the ceiling price. Others who sold on a spot basis will take a loss. Price fixing will be of advantage to producers and will stabilize operations materially.

▶ North of Plymouth the Ballard Mother Lode Mines, Inc., John Ratto, of Sutter Creek superintendent, is shaft sinking and preparing to develop.

▶ The Bella Oaks quicksilver property near St. Helena is reported to have been taken over by F. Bahich, who expects to move equipment from the La Jolla property preparatory to exploring the Bella Oaks.

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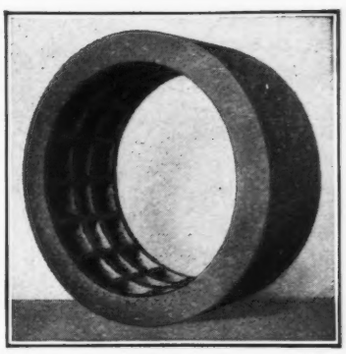
LINERS FOR ORE CHUTES
LINERS FOR HOPPERS
SCREEN PLATES
GRIZZLY BARS
CLASSIFIER CAMS
UNDERGROUND ORE SCRAPERS



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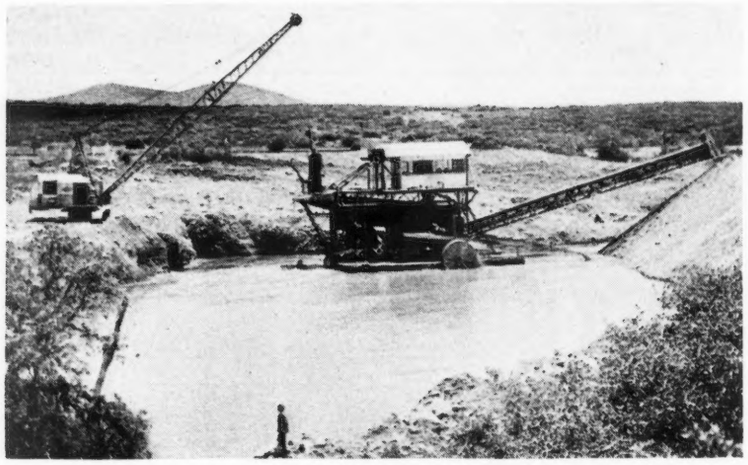


Arical Mines, Inc., Mayer, Ariz., is working tight gravel 40 ft. in depth in Big Bug Creek with a special bucket on a Lima dragline. The dredge is equipped with Pan-American jigs

ARIZONA

Plants to Treat Manganese ore Proposed

Deposits in Artillery Peak district could utilize electric power from Parker Dam for exploitation and treatment—Hematite deposit being prospected

▶ The Department of the Interior has recommended to Congress as a war defense measure the establishment of a milling plant at Artillery Peak, in the southern part of Mohave County, to handle 240,000 long tons of manganese metal and to mine 3,000,000 tons of manganese ore. The request to Congress also involves the construction of mill at Parker Dam and the mining of 100,000 tons in that district. Artillery Peak is about 30 miles from Parker Dam on the Colorado River, where electrical power is available. The U. S. Bureau of Mines made extensive examination of this manganese deposit during the past two years. Millions of tons of ore were found, but it is of a grade that will require treatment to comply with the present Federal requirements for manganese content.

▶ The U. S. Bureau of Mines, under the direction of William F. Storms, of Tucson, is doing road construction and sampling of the Canyon Creek iron deposit preparatory to diamond drilling. The ore is hematite in limestone in blanket formation and is about 10 ft. in width. The outcrop is shown for a long distance. Canyon Creek is about 20 miles west of Cibique and about 15 miles from the junction of Canyon Creek with Salt River.

▶ M. B. Dudley, of Kingman, president of Mines Development, Inc., has taken over the Siamese-Pittsburg mines, in the Cedar Valley 40 miles south of Kingman on the west slope of the Hualpai Mountains. This property has considerable deep development and known bodies of ore are blocked out and available. It has been owned by Leonard and J. H. Hoffman, of Kingman, for the past 30 years. The values are in lead, silver, and zinc. A mill was erected on the property some 35 years ago, but the savings were unsatisfactory and the subsequent drop in metal prices caused the mill to be shut down. The old road is now being put in condition for the hauling of machinery and supplies to the camp, which has been rehabilitated to care for a mining crew. Dudley is now in the East consulting with associates.

▶ In a unanimous decision the National War Labor Board on Feb. 21 denied the request of the International Union of Mine, Mill and Smelter Workers, CIO, for a $1 a day wage increase and a union shop for the 700 employees of the Phelps Dodge Corporation's Douglas Smelter Division, Douglas, Ariz. The company, which employs 6,000 to 7,000 men in mining and smelting of copper in Arizona, had recently completed contracts with AFL unions for most of these employees, embodying, the Board found, "significant improvement in work standards." In writing the opinion of the Board, Dr. George W. Taylor, vice chairman, pointed out that changes, such as the CIO union requested, would upset the prevailing standards in Arizona as established by union contracts. The case was certified to the Board Jan. 14 and was heard by an investigation panel of Board members—Dr. Taylor, R. R. Deupree, and Clinton Golden of CIO—on Feb. 4 and 5. This investigating panel unanimously recommended the disposition of the case, which was then unanimously adopted by the Board. The text of the findings and the decision of the Board as written by Dr. Taylor were concurred in by Richard R. Deupree, Clinton S. Golden, William H. Davis, Frank P. Graham, Wayne L. Morse, Roger D. Lapham, George Meany, Matthew Woll of A F of L; Robert J. Watt, E. J. McMillan, and A. W. Hawkes.

▶ Mercuria Mining Corp. has commenced operations on its quicksilver properties in the Sunflower district near Mesa. The old Ord property has also been taken over by the company and will put the mill in condition for production. Ten men are now at work on the property and it is expected that more will be added as the work progresses. Most of the present ore is taken from the Mercuria mine. Albert H. Johnson, of Mesa, is directing the operations.

▶ Horace Armishaw is working the old Tuckahoe mine, a mile northwest of Chloride. This property produced a considerable tonnage in past years but has lately been idle. Gold and silver ore is now being trucked to the mill of the Producers, Inc., 7 miles west of Chloride.

▶ Golden Gem mine, in Cerbat Canyon, 12 miles north of Kingman, has been taken over by Ralph W. Langley, of Los Angeles. Mining and milling equipment is being reconditioned. The 300-ft. level is being put in readiness for further stoping and production. A. C. Dundas, who has operated the property for the past two years, retains his interest and will continue as superintendent in charge. Mr. Langley has also taken over the Merrimac and Helen May properties, near Chloride, under bond and lease, and plans to equip them with machinery and get into production soon.

▶ M. B. Dudley, owner of the old C. O. D. mine, 12 miles north of Kingman, reports the property under lease to R. P. M. Davis, of 2356 Hollyridge Drive, Hollywood, Calif., who is operating a mill handling dump ores. Plans are made for opening up some of the old workings and mining ore for the continued operations of the mill. Davis is president of the Liberty Hill Gold Mines Co. at Congress Junction, Ariz.

▶ Halsey Williams and Ed. Hussen, of Quartzsite, Ariz., are doing development work on the Copper Bottom mine, owned by them and situated 10 miles south of that town. They are driving a tunnel to cut the vein at a lower level. Considerable high-grade copper and gold ore has been shipped from surface and shallow workings.

▶ Producers, Inc., operating a cyanide mill on custom ores 7 miles west of Chloride, have been examining a number of lead-zinc properties in the Cerbat Mountain area, looking for a possible tonnage which will warrant the addition of a selective flotation plant to their present cyanide mill. H. W. Thorne is general manager of the company.

▶ The old mill on the Bi-Metal mine, 3 miles southwest of Kingman, is being put into condition to handle the ores from the mine. The Geronimo Gold Mines, Inc., acquired control of the property some months ago. In former years a considerable tonnage of gold ore was shipped to the Tom Reed mill, at Oatman, for treatment. Mining is open pit, the ore being handled with a power shovel. The gold deposit is along a shear zone which has been prospected for some distance with satisfactory results. Charles Wilkinson is superintendent in charge of operations. Leslie Saunders, of 414 James St., Los Angeles, is president of the company.

▶ Henry Green and Charlie Slaughter are shipping a carload of ore about every six weeks from the New Jersey mine, which they have under lease. The property is about two miles westerly from Chloride and had considerable production in years gone by. The ore is shipped to El Paso and carries values in gold, silver and lead.

UTAH

Mine Operators Await Their Output Quotas

Production meanwhile continues at high rate—Utah Copper Co. raises pay of all daily wage workers

▶ Utah operators for the most part remain still in doubt as to what effect premium prices for over-quota production will have on future earnings. Until they receive their quotas, they are unwilling to make any prediction. For mines like the Utah Copper, which in 1941 reached a new all-time high of 514,000,000 lb. of copper not taking into account 9,000,000 lb. of molybdenum and some silver and gold, premium prices are not likely to bring much increase. To produce more, Utah Copper will have to erect another mill. There is hope that the plan will give some consideration to mines like Utah Copper that placed an undue strain on their equipment, ore reserves, and personnel to produce a maximum in 1941. A number of the old and more recently developed mines, which have opened up new ore reserves, will be benefited. Operators, however, hold that the new plan will involve a greatly increased volume of accounting and paper work.

▶ An increase of 25c. per shift for all day-wage workers at the Utah Copper, effective January 16, has increased the pay of machine miners to $7.20; mechanics, $7.70; mill operators, $6.80; and common labor, $5.40.

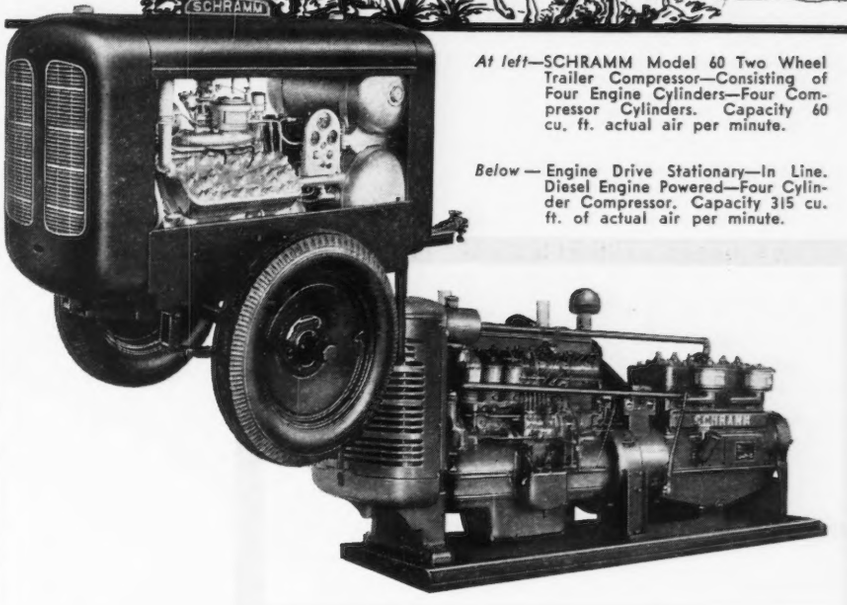
▶ Silver King Coalition Mines reports a net profit of $395,271.80 for 1941, or 32.4c. a share, compared with $467,076.95 or 38c. a share, in 1940.

▶ National Tunnel Mines Co., operating through the recently completed Elton Tunnel, is unwatering the Rood shaft to the 3,100 and 3,300 levels, prior to starting the mining of a large body of copper ore left in the old workings.

▶ Charles H. Segerstrom, of Sonora, Calif., who is mining scheelite ore from the Prosper Mining Co.'s Old Hickory shaft near Milford, announces that he will erect a mill of at least 100 tons' daily capacity. About 8,000 tons of 2 percent tungsten ore has been stockpiled on the property, it is reported. Segerstrom will also operate the nearby Copper King property.

▶ The Cupric mine, 18 miles west of Milford, is being tested. The Little May mine, according to Manager John Matson, 33 West First South St., has leased its tungsten claims on the Milford Lily claims, near Milford, to California interests, who will seek to develop the scheelite ore opened up by prospecting.

▶ New Park Mining Co., Keetley, Utah, has its new shaft down 100 ft. below the Mayflower tunnel level. The Mercur Dome Gold Mining Co., Continental Bank Building, which is sinking an incline shaft in its Mercur property, has reached a strata 90 ft. above the objective Madison limestone at a point marking a depth of 800 ft. in the shaft.



At left—SCHRAMM Model 60 Two Wheel Trailer Compressor—Consisting of Four Engine Cylinders—Four Compressor Cylinders. Capacity 60 cu. ft. actual air per minute.

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NEVADA

Gold Producers Feel Pinch of Priorities

Some properties on verge of suspending operations due to inability to obtain equipment—Snow holds up quicksilver deliveries from mines

▶ Producers of precious metals are beset by nightmares induced by a heretofore indefinable but already active exercise of priorities applying to their operations. The Northumberland Mining Co., operating a 350-ton cyanide mill on low-grade gold ore mined from an open cut at a point 100 miles from a railroad in northern Nye County, may be compelled to close down for need of unobtainable equipment parts. Oro-Nevada Dredging Co. may for the same reason suspend its successful operation of a dragline dredge in Gold Canyon, below Silver City.

▶ Production of mercury in Nevada has decreased within late months, partly because snow has blocked some roads from supply points. The Cordero Mining Co., subsidiary of the Sun Oil Co., has continued to produce up to eight flasks per day from its 120-ton Nichols Herreshoff furnace in northern Humboldt County. In eastern Pershing County the Mount Tobin Quicksilver Co., controlled by Henry W. Gould, of San Francisco, continues to produce 30 flasks monthly. Deep snow compelled the Mina Mercury Co. to close down its furnace in Mineral County. With exhaustion of available ore, the McAdoo Mining Co. closed down its 30-ton furnace plant in the Bottle Creek district, Humboldt County. Heads of the Summit King Mines, Ltd., subsidiary of Bralorne Mines, Ltd., have relinquished an option on formerly productive cinnabar property in Pershing County and in the same Antelope Springs district the Harold's Club Mercury Co. suspended work and production from three retorts.

▶ Construction of an electrolytic plant designed to produce 112,000,000 lb. of magnesium metal annually is in progress in Nevada, with some 5,000 men employed and prospects that this number will be doubled by midsummer. Shortage of housing facilities has delayed the project, officers of the Basic Magnesium, Inc., for which the $63,000,000 plant is being built, charging that civic bodies and others at Las Vegas have enlisted political influence in opposition to any housing construction outside of that town, 15 miles distant. At the Gabbs Valley magnesite deposits, some 350 miles north, construction of a $3,000,000 calcining plant has started, and the contractor, Macdonald Engineering Co., of Chicago, has completed buildings and camp facilities for 400 employees. Production of the metal is to start in May.

▶ A pilot concentrating mill, completed lately at the Twin Buttes Syndicate mine, in western Pershing County, will treat 30 to 50 tons per day, depending on water supply, of heavy sulphide ore containing gold, silver, lead, zinc and antimony. Shipments of a dozen carloads, trucked 60 miles to Lovelock for rail shipment to a Utah smelter, have ranged in value from $35 to $60 per ton. J. B. Stott, manager, and E. Heineke, resident engineer, report 2000 tons of plus-$20 ore on mine dumps and 15 faces in tunnel workings from which mill ore may be drawn. The flowsheet, designed to produce a $70 to $80 concentrate from the lower-grade ore, includes jaw crusher, Allis-Chalmers rolls, and two Wilfley tables—all used equipment. Power is supplied by a new 50-hp. Allis-Chalmers gasoline engine. Developed by a shaft and three tunnel levels, the claims were acquired as a new prospect less than a year ago, the project being financed by a San Francisco group headed by A. B. Swinerton, who headed also the Pacific Syndicate, for which Manager Stott developed the open-cut mine of the Standard Cyaniding Co., now operating a 700-ton cyanide mill near Rye Patch, in central Pershing County. Mail for the mine is received at Lovelock.

▶ Cinnabar from a surface deposit, mined by power shovel on the Washington Hill mine, 12 miles north of Virginia City, is being trucked at the rate of 150 tons per day to the remodeled flotation mill of the South Comstock Gold Mines, Inc., at Silver City, Lyon County. Mill-run tests were said to have given a satisfactory result by flotation. C. D. Terwilliger, First National Bank Building, Reno, is president and manager.

▶ Additions to mill equipment by the Sierra Nevada, Ltd., operating at the north end of the Comstock lode, will soon enable handling 700 to 800 tons per day of low-grade surface and open-cut ore by gravity concentration, flotation having been discarded. Indicated recovery of gold and silver is around 70 percent, with 50¢ cost of mining and milling. Arthur Blake Thomas is manager at Virginia City.

▶ Near the Humboldt-Lander County line, Western Alloys Inc., is treating, with washer, crusher, and jigs, 300 tons of manganese ore per day and shipping its produce from the Valmy rail point to the government arsenal stockpile at Ogden, Utah. P. A. Mattingly, Felt Building, Salt Lake City, is president; J. F. Featherstone is vice president and manager, and D. B. Pelton is superintendent at Valmy, Nev.

IDAHO

Lead and Zinc Mines Boosting Output

High-Grade lead orebody being exploited near Murray—Douglas Mining Co., will resume production

▶ The Jack Waite mine, near Murray, operated by the American Smelting & Refining Co., has doubled its production of high-grade lead ore since the war emergency. Jack Waite claims lap over the mountain range dividing Idaho and Montana, with most of the ore now being mined in Montana and milled in Idaho. The lead ore is the purest in the district, running exceptionally high in lead.

▶ Hecla Mining Co. declared its initial dividend for 1942, distributing $250,000 among its 8,000 stockholders at the rate of 25c. per share. Total dividends paid to date amount to $25,155,000. The mine has gone on a seven-day week basis to help the war-time demand for lead and zinc. The Star mine and mill, operated by the Sullivan Mining Co. through the Hecla shaft, is also operating at top capacity on a seven-day basis. The Sullivan company's big electrolytic zinc plant at Kellogg is working full time on an all-out production of zinc.

▶ Big Buffalo gold mine, about 80 miles southwest of Grangeville, will be reopened by Knowles Brothers, Idaho and Nevada trucking contractors, who have purchased the property through the estate of the late Charles Sweeney, organizer of the Federal Mining & Smelting Co. Walter Hoovey Hill, Grangeville mining engineer and first superintendent of the Big Buffalo in 1898, announced completion of the deal and stated that a mill has been purchased along with other machinery. The ore will be ground to 63 mesh and the gold recovered by cyanide. The Big Buffalo group consists of 23 lode and five placer claims, comprising 300 acres of patented ground at an elevation of 7,500 ft. The property was involved in a $1,000,000 deal with Capt. J. R. DeLamar, of Paris, in 1898, and has had several owners through the years.

▶ Douglas Mining Co., owning 15 patented claims in the Pine Creek district west of Kellogg, will resume production as soon as machinery can be installed under probable joint management of the Bunker Hill & Sullivan and Hecla companies. Lead-zinc ore from an old stockpile is now being shipped to the Silver Crescent mill. The property was first operated by the Anaconda Copper Mining Co. in 1917 and 1918. A forest fire completely destroyed the surface plant in 1924. Anaconda engineers estimated 100,000 tons of zinc-lead blocked out ready for mining.

▶ Lucky Friday Mining Co., operating in the Mullan district of the Coeur d'Alenes, has completed a test run of 500 tons of silver-lead-zinc ore at the Golconda mill. In one run the lead concentrate averaged 272.7 oz. silver; 53.6 percent lead, and 8.6 percent zinc. The zinc concentrate ran 29.18 oz. silver; 0.9 percent lead and 58.9 percent zinc. This ore was taken from the 300-ft. level and the shaft is now being sunk to the 500-ft. level, with three shifts employed. A new air compressor was installed, along with a new hoist, headframe, and skip pocket. Golconda Mining Co. is financing 400 ft. of the Lucky Friday shaft development.

▶ The Gibbonsville Mining & Exploration Co. has entered into a contract with the Western Knapp Engineering Co., of San Francisco, for construction of a 200-ton slime flotation plant to be located a few miles west of Kellogg. Engineers estimate there are enough old slimes on the ground to last a 200-ton mill for at least three years, with recoverable values totaling around $1,000,000. Both a lead and zinc concentrate will be produced. Walter C. Clark, Kellogg engineer, heads the new work.

▶ Mica deposits near Placerville, Idaho, are the scene of new prospecting, with indications of tungsten and other stra-

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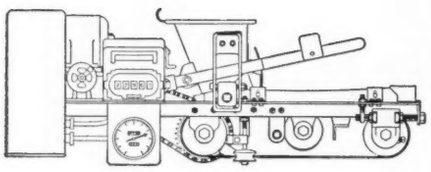

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tegic minerals present in commercial quantities. A considerable quantity of mica was mined on Wash Creek during the first World war.

▶ Coeur d'Alene Mines Corp., operating in the Coeur d'Alene mining district, expects to encounter its orebody in the new crosscut on the 1,800-ft. level early in March. The body of high grade silver ore opened on the 1,600 level is now being prepared for stoping operations. The 600-ton mill is operating at capacity, with the ore being hauled to the Bunker Hill smelter at Kellogg.

▶ The recent congressional attempt to repeal the silver act has aroused indignant protests from Idaho silver miners, according to Harry W. Marsh, secretary of the Idaho Mining Association, and Earl Murphy, secretary of the Idaho State Chamber of Commerce. They state that many marginal mines in Idaho now producing lead and zinc ores depend largely on the present silver price for their margin of operating profit. With lead and zinc so closely associated with silver in Western ores, repeal of the silver act would mean the closing of many mines.

▶ The United States circuit court in San Francisco has rendered a decision ordering the Sunshine Mining Co. to pay back wages to employees involved in the 1937 strike. The amount of money involved is said to be around $300,000. The National Labor Relations Board held the company liable for the strikers' wages during the time they were idle.

ALASKA

Priorities Affecting Small Gold Operators

Large dredges, however, are ready to commence operations in the spring—Work suspended at Treadwell mine

▶ Alaska mining men are looking with some misgivings into the future for 1942. Development and exploration have been slowed up, partly due to priority problems. Fairbanks, however, reports that preparations are now under way for the resumption of operations on a large scale this spring by the U. S. Smelting, Refining & Mining Co. J. E. Hopkins, manager, reported before he left for a short trip to the States that all the company's dredges are going into operation as usual. In the Mayo district the outlook is not so good, for the Treadwell mine is closed because of the low price of silver on the Canadian side.

▶ Dan Creek Placer Mines, Inc., has filed its articles of incorporation at Juneau and will develop property in the Nizina district. John J. Price, of McCarthy, and L. A. Levensaler and Joshua Green, of Seattle, are incorporators.

▶ Abandoned mine tunnels in Alaska are being examined as possible bomb shelters. Arthur Riendeau, of the Alaska Juneau Mining Co., and John Kennedy, president of the Juneau Miners' Union No. 23, have been investigating and report that the old Boston Group mining tunnel at Juneau, could accommodate 100 persons if duck boards are laid on the bottom and seats built on the side.

▶ Idaho-Canadian Dredging Co. will build a dredge this summer at its property on Big Gold Creek, in the Dawson district, and expects to have it in operation next fall. The company has eight miles of virgin dredging ground which it obtained from William Williams, a pioneer placer miner of that district. Since the freeze-up last fall operations have been suspended except for a crew which is engaged in building a new camp. F. J. Friedel, managing engineer, has been engaged in procuring essential equipment and supplies for the spring operations.

▶ To determine the status of Alaska-Pacific Consolidated Mining Co., a complaint has been filed in the federal court of Alaska by the wage and hour division of the United States Department of Labor. The complaint asserts that the company has required some of its 200 employees to work in excess of 40 hours per week without paying them time and a half for overtime. The complaint also asserts that the company has shipped out of Alaska gold and concentrates produced in violation of the law and that it has failed to keep adequate records. This is the first action in Alaska by the wage and hour division against a mining firm, and the decision is expected to clarify overtime requirements of the act. The company's operations are near Wasilla.

▶ H. E. Ellis has been lost in the Brem-

Cold water thawing at Center Creek placer area near Nome, Alaska

ner mines district, out from Valdez, since last summer. Searching parties have failed to find any trace of him. He injured his knee last summer, and this it is feared may have made it impossible for him to mush out in October as he said he would. He was once one of the owners of the Cliff mine and has been in the Valdez district 40 years. Mrs. Ida E. Bush, his sister, living in Jacksonville, Fla., is asking assistance in locating him.

WASHINGTON

Copper Mine Near Chewelah Being Reopened

Mining throughout State has been stimulated by war effort—Germania tungsten mine reopened

▶ Seattle and other interests of the State are reopening the United Copper mine, near Chewelah, in Stevens County. C. H. Clodius, a former banker of Ritzville, is at the head of the enterprise.

▶ General Electric Co., in its nation-wide quest for tungsten ore, is reopening its Germania mine, 60 miles northwest of Spokane. John R. Shattuck, a California mining engineer, is in charge.

▶ A resolution has been sent to Anthony Dimond, Alaska delegate in Congress, stating that enforcement of the wage hour law in the Territory may force many small mines to close. The resolution comes from the Alaska Miners' Association of Seattle.

▶ Moved by the importance of building defense industries at points inland from the Pacific Coast line, construction of a second and third such plant has been announced in the area close to Spokane, and work has started. The first plant, heretofore announced, will produce aluminum. It will cost $9,400,000 and will be situated outside of the limits of Spokane. Much work already has been done in preparing the ground and in initial construction. Across the highway from this enterprise Bonneville Power Administration is building at a cost of $1,350,000 the first unit of a new substation to serve two power lines now being built from Grand Coulee dam. Besides these definite enterprises others are under consideration to use magnesite, dolomite, and other mineral resources, of which there are a great abundance in eastern Washington, especially in Spokane and Stevens Counties.

▶ Grandview Mines Co., in the Metaline district, in paying its February dividend of one cent a share, found that its stockholders numbered 2,460, scattered all over the United States and British Columbia. Total shares issued amount to approximately 3,000,000. The plant is running at capacity. H. Louis Schermerhorn, of Spokane, is president and D. I. Hayes is in charge.

▶ Silverado Mining Co. has been formed and has acquired the old Daisy mine, in Stevens County, 7 miles west of Daisy on the Columbia River. E. C. Tousley, of Spokane, is head of the enterprise. F. M. Mitchell, of Wenatchee, is president of the company.

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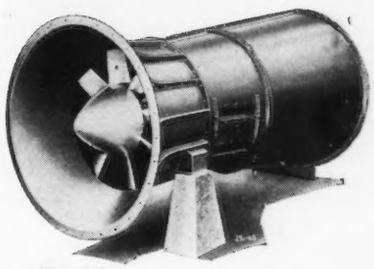

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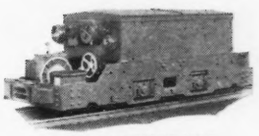

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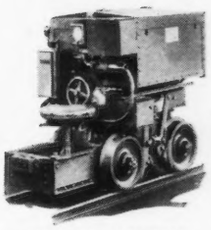

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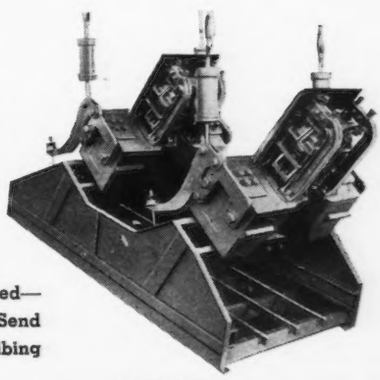

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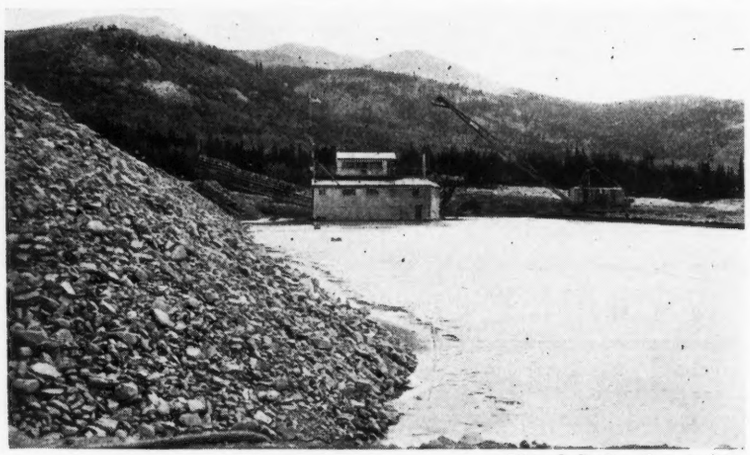

Thos. J. Barbre, Denver, Colo.

Near Como, Colo., the Cooley Brothers are operating a modern electrically driven gold dredge. Gravel is dug by a Bucyrus-Monighan dragline and power to the dredge is supplied through G.E. lead-covered cable seen in the foreground

COLORADO

Vanadium Plant At Rifle Completed

Operations are now under way—Activity at many base-metal mines is increasing

▶ This is the third year that the Uravan mining section has ranked first in total tonnage of vanadium concentrates shipped which totaled over 200,000 tons in 1941. This is the largest vanadium-producing field in the world, and two major companies operate mills within a few miles of each other. The U. S. Vanadium Co., at Uravan, operated its 300-ton mill to capacity all year and recently completed construction of a large mill at Rifle, Colo., which started operations in February. Mine exploitation and development are proceeding at a rapid pace in this area, as well as in Utah near the Colorado state line, where shipments of vanadium ore are being made by truck to a Colorado recovery plant. Fires were recently started also in the furnaces in a new vanadium recovery unit at Rifle.

▶ Ed. Rossiter and Henry Pryor, who leased the dumps of the old dismantled American Smelting & Refining Co.'s smelter at Durango, are shipping slag, averaging from 7 to 27 percent zinc. The dumps contain a large tonnage which was the accumulations of fifty years smelting operations.

▶ The silver-lead mines in the Creede district operated at full capacity during 1941. As all mining operations are carried on by the Emperius Mining Co. and its affiliated connections under the direction of President B. T. Poxson and consulting geologist George H. Garrey.

▶ Shenandoah-Dives Mining Co. continued its policy of large development work along with the general run of mining and milling operations during 1941 and some 1,500 ft. of new work was completed above the main level. In past years, a raise of 1,700 ft. was completed and a modern equipped hoisting plant installed. Serving as connections between the company's holdings in Arastra Gulch and those on King Solomon Mountain opening on Cunningham Gulch, the new level from the raise is developing the famous North Star vein under the mine of the same name, and operated for years by Warren Prosser. General manager Charles A. Chase has the deepest mining in San Juan County, and this includes work in the "zero" country, now 400 ft. below the main level section of the North Star, though other veins have been opened to a depth of approximately 2,500 ft. below surface outcroppings. Considerable time will be required before North Star fraction veins can be reached through the big raise and thus moved to the mill.

▶ Raymond G. Sullivan and Joseph Rodgers are building a new 50-ton concentrator for tungsten ores on the Hugo ranch on North Boulder Creek, and for the Boulder Tungsten Mills. Leon Caine is president of the new company, and both Messrs. Sullivan and Rodgers will devote part of their time to the Slide Mines as well as to the new company.

▶ The Alma Lincoln mine, at Idaho Springs, has opened a new body of ore in the Cardigan vein, and from present indications output will be increased soon.

▶ Practor C. Milliken, operating the Henry mine, in the Lamartine mining district, has moved the mill erected by Myers and Associates at the Old Town mine in Russell Gulch to a point three miles east of Idaho Springs on Highway No. 40. The mill is equipped to handle all classes of ores for straight flotation and table separation, and it is now planned to add selective flotation for the separation of lead and zinc.

▶ The Golden Conqueror Mines, Inc., with A. S. Konselman, general manager, and A. W. Deener, superintendent, made substantial shipments of gold ore from the Cripple Creek district in 1941.

▶ At the Portland Gold Mine, Cripple Creek, H. H. Salisbury, superintendent,

states that cleaning up and retimbering were pushed during the past year, getting ready for the new development program, outlined as a result of the New Carlton drainage tunnel. Much new ore is in sight, and already ore is being shipped from the lower levels, which were under water for years.

▶ Superintendent Shirley Johnson states that the most important new development at the Tenderfoot Mining Co., which carries on its work through the Sangre De Cristo tunnel and the Mollie Kathleen shaft, was the installation of a new ventilating system.

▶ A. H. Bebee, general manager of Carlton interests in the Cripple Creek district, states that the 1942 program calls for the driving of the two laterals from the Carlton tunnel to the Vindicator mine, a distance of 5,000 ft., and to the Cresson mine, a distance of 4,000 ft. All tunnel operations henceforth will be carried on through the Portland shaft. A new 300-hp. motor has been installed on the mine's hoist, along with new flat cables capable of reaching the tunnel level. As a result of this new tunnel, one of the most important mines to benefit was the El Paso, on Beacon Hill, taken over in March, 1914, by Tom Copeland and James Knight. They are now sinking a second winze on the C. K. and N. vein, all work on which was formerly under water. The water level in the Cresson mine has been lowered some 240 ft., and the nineteenth level, 250 ft. below the old Roosevelt tunnel, is now completely dry, and clean-up work on this level is under way. As soon as the shaft work in the Portland is completed to the Roosevelt tunnel level, work on these two laterals will begin.

▶ The Golden Cycle Corp. has sunk the Ajax shaft to the 28th level and the station is now being cut. A sump is to be sunk at this level, during which time the sinking of the shaft will be discontinued. This new 27th level is 150 ft. below what was formerly the mine's bottom and 2,748 ft. below the shaft's collar. Levels, which were formerly pumped—the 21st, 23d, 24th, and 26th—are now being developed extensively; and ore of good grade has been developed.

▶ Golden Cycle's mill superintendent, Max Bowen, reports the treating of 535,000 tons of ore, valued at $5,533,176 in 1941.

Chrome Ore in Small Lots Being Purchased

METALS RESERVE CO. announced at the end of February that it would purchase chrome ore in truckload lots from miners in Oregon and northern California. Buying agencies to implement this new policy have been set up in Coquille, Grants Pass, and Seneca, Ore., and Yreka, Cal. The new policy results from pleas from a delegation headed by Earl K. Nixon, director of the Oregon Department of Geology and Mineral Industry, that if RMC would buy in smaller lots, larger over-all domestic production could be obtained. Previously, purchases were restricted to 1,000-ton lots of ore.

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The need for conserving vital metals and man-power makes the use of Amsco-Nagle Horizontal and Vertical Shaft Centrifugal Pumps all the more important.

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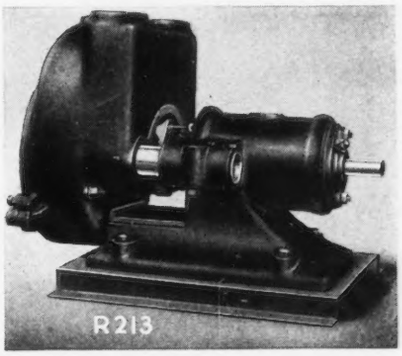

Note accessibility of stuffing box on this Amsco-Nagle 1½" Type "A" Frame 7 Horizontal Pump (R213). Casing can be removed after loosening nuts on bolts clamping the tube supports.

Impeller is screwed on. Water end on horizontal pumps held on by three clamp-dogs. This is a 2" Type "T" Frame 10 unit (R222).

Pumping end, bearings and floor plate are rigidly tied together by tubular members which also function as discharge pipe and lubrication duct, respectively, in this 2" Type "SW" Frame 10 Amsco-Nagle vertical shaft pump (R282) which has a setting (or submergible length) of 14 ft.

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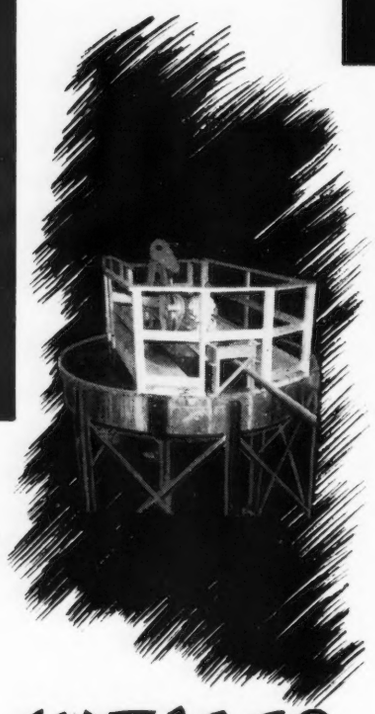

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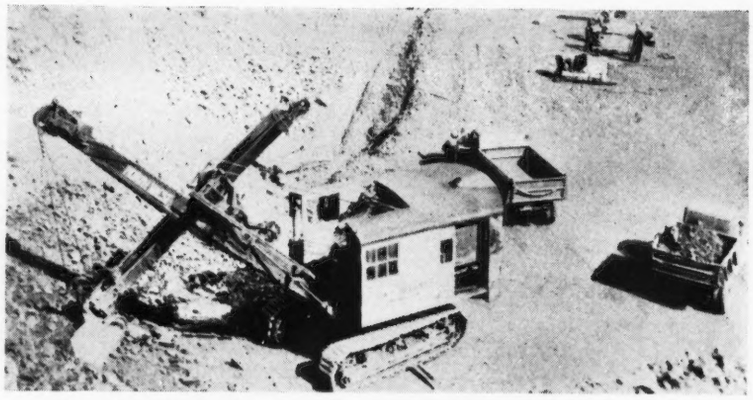


On the Menominee Range, near Iron Mountain, Mich., the Bradley open-pit mine has a 1 cu.-yd. Northwest shovel that digs the broken ore and loads it into 1½-ton trucks for hauling to the crusher plant

IRON COUNTRY

Companies Preparing For Another Record Season

Estimates of 1942 output reach close to 90,000,000 tons—Open pit mines will contribute greatest increase in output.

▶ All mining companies are working full time preparing for the heavy demands to be made on them when navigation opens in April. A relatively mild winter has aided operations generally, except that digging operations have been hindered by the deep penetration of frost. Preparations are being made to meet the necessary demands of the steel plants for close to 90,000,000 tons. Steel-plant capacity is now a little better than 88,000,000 tons per year, and new furnaces and plants are coming into operation within the year; so all the iron ore that can possibly be shipped must be forwarded during the eight months' navigation season.

▶ The increase over 1941 shipments must be made by the great open pits of the Mesabi Range, inasmuch as the underground mines of the other ranges are lacking the large stockpiles that were in evidence up until 1941. Underground production is limited in expansion, and so the burden of increased production that is so vitally needed for the all-out war effort falls on the open-pit mines.

Mesabi Range

▶ The University of Minnesota Geological Department claims the possibility of a hitherto unknown iron-ore deposit somewhere between Cloquet and Eveleth, Minn. Recent studies caused the geologists to believe that the "slate and graywacke" formation in the territory in question is older than the ore-bearing "Biwabic formation." If this is true, the ore-bearing formation may have turned upward after striking the slate from above and may be near enough to the surface to be found again. Field investigations have been carried out by Professor George M. Schwartz under the supervision of Dr. Frank F. Grout—both of the University of Minnesota. These two men say that if the formation is found, it might contain ore ranging "from a bushel to another Mesabi Range."

▶ Requests for funds to carry out an investigation by geophysical methods of this area have been made and at the present time plans call for a three months' exploration during the summer of 1942 under the direction of Professor Schwartz. The possibilities of a new orebody being found are necessarily important at this time, due to the heavy drain on the present ore reserves in Minnesota. State and local officials are working out various problems of rehabilitation that will necessarily result from the enormous shipments that will be made from Minnesota during the next few years.

▶ A State prospecting permit was recently issued to the E. W. Coons Co., Inc., in Hibbing, for the Hanna iron ore pit at Mt. Iron, Minn. The property has been idle since 1925, when it was operated by the Consumers Ore Co., with the M. A. Hanna Co. as agent. The mine now has 330,423 tons available and unmined.

▶ Oliver Iron Mining Co. has commenced construction of a truck haulage-belt conveyor system for the removal of the Alpina stock-pile near Virginia, Minn. This pile contains 2,500,000 tons of ore and is a familiar landmark around Virginia.

Menominee Range

▶ The Bradley open pit mine now under lease to the Jackson Iron & Steel Co., Jackson, Ohio, was formerly known as the West Ludington. The ore contains about 38 percent iron, 42 percent silica, and is low in phosphorus. Equipment consists of a 1-cu.yd., Northwest gasoline-operated shovel for loading the ore into four 1½-ton capacity trucks, which haul and dump into a 16-in. Allis-Chalmers gyratory crusher, from which the ore goes directly into railroad cars. The crusher is driven by 100 hp. Allis-Chalmers motor. Drilling operations are maintained by the use of an Armstrong churn drill and Ingersoll-Rand wagon drill using Jackbits. Air for the wagon

drill is supplied by two Ingersoll-Rand portable compressors. Ore is stockpiled in the pit as it is mined from the different pit locations. The Bradley mine is operated on a tonnage basis by Edward C. Bradley, of Iron Mountain, Mich., and has produced 65,000 tons of ore in a season.

Gogebic Range

▶ Oliver Iron Mining Co. is now operating six days a week for both day and night shifts. This change became effective on Jan. 26.

Marquette Range

▶ The Marquette Range Industrial Union has started negotiations with the Cleveland-Cliffs Iron Co. for a labor contract covering workers at the Princeton and Negaunee mines, operated by the company. The Range union already has six contracts with the Cleveland-Cliffs Iron Co., covering employees at the Cliffs shaft, Lloyd, Athens and Mather mines, the Tilden open pit, and Cliffs Power & Light Co.

MICHIGAN

Kearsarge Copper Mine Being Rehabilitated

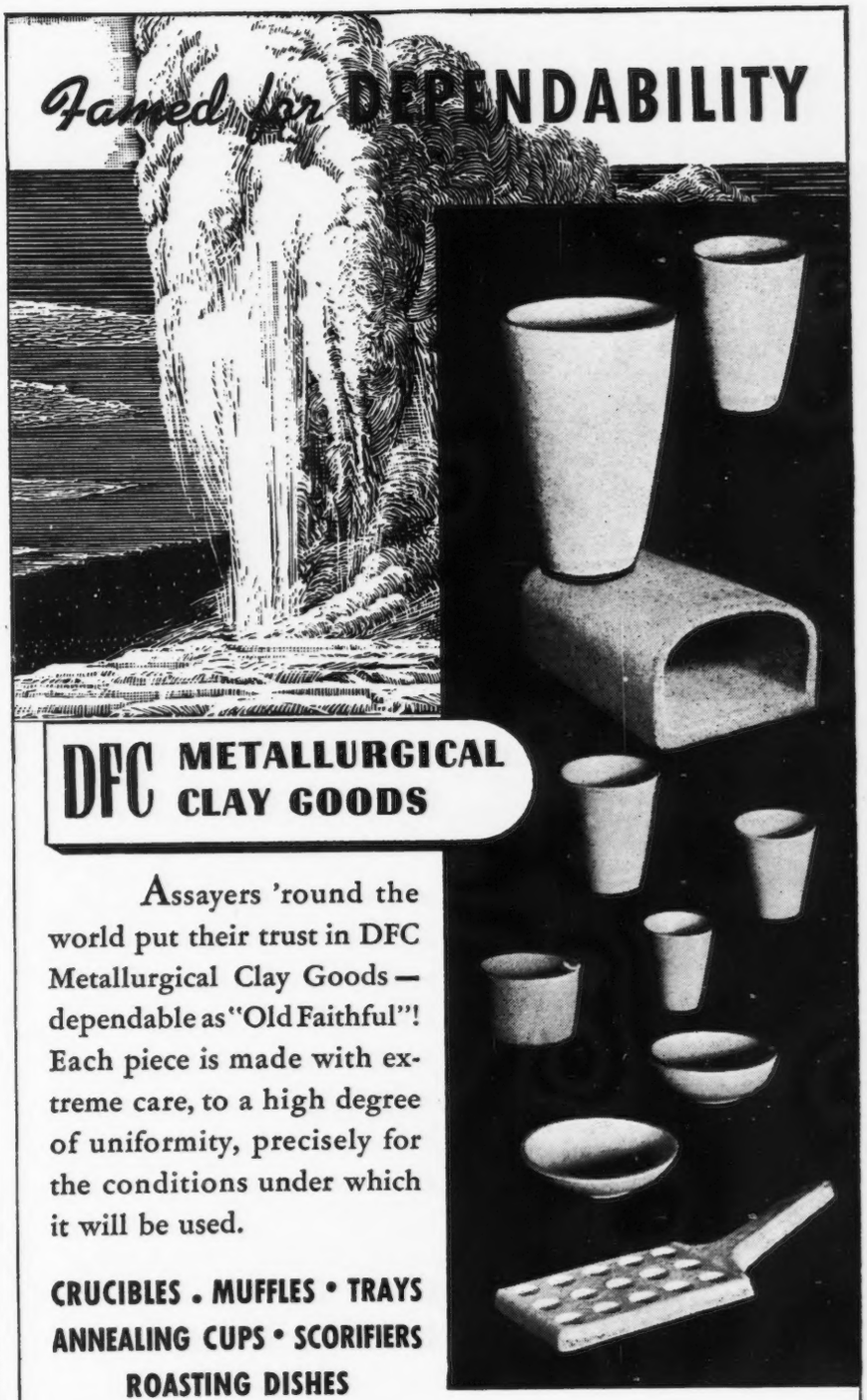
Property is expected to be in production this spring—Copper producers preparing for greater output

▶ Calumet & Hecla Consolidated has started preparations for the reopening of Kearsarge No. 4 shaft. Considerable rehabilitation is necessary and actual production of copper from this unit may not begin until early in May. It is hoped to employ about 100 men. Mining operations will be in charge of Capt. Samuel Richards.

▶ The agreement between the company and the War Production Board to reopen the Kearsarge is not included in the arrangements for the production of new copper at a bonus price of 17c. Negotiations are under way with the WPB looking to the possible opening of other production units of the company.

▶ Copper Range, Quincy, and Isle Royale, the producing mines in the south end of the Houghton County copper district, are preparing to take advantage of the proposed bonus price of 17c. per pound for copper produced in excess of 1941 output. Sinking and drifting have been increased. Isle Royale has put on an extra shift and is engaged in deepening No. 4 shaft below the 38th level.

▶ At a meeting of the shareholders of the Peninsula Copper Co. a substantial majority voted for a modification of the lease and option by Calumet & Hecla Consolidated, under which the term of the option might be extended from year to year after July 1, 1943 (the expiration date), on the payment of reasonable yearly installments on the purchase price.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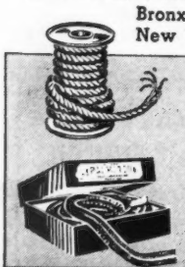

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Mining Branch, Materials Division, War Production Board

FOLLOWING is a list of names comprising the staff of the Material Division of the War Production Board for the mining industry. To expedite mail delivery in Washington. Donald Nelson, head of WPB, introduced the system of having letters earmarked by the number of the order involved, where it is a priority matter, rather than by individual names. For example, when writing on P56-A problems, communications should be addressed "War Production Board, Washington, D. C. Ref. P56-A."

Wilbur A. Nelson, Administrator of Mining Branch, formerly head of Department of Geology, University of Virginia, Charlottesville, Va.

Dr. Marcellus H. Stow, Assistant Administrator of Mining Branch, formerly head of Department of Geology, Washington and Lee University, Lexington, Va.

Dr. Marcellus H. Stow, Technical Advisor for Metal Mines. See above.

F. Stuart Miller, Associate Technical Advisor for Metal Mines, formerly consulting geologist for F. W. Schumacher interests, Toronto, Ontario.

Joe C. Arundale, Assistant Technical Advisor for Metal Mines, formerly with Eagle Picher Mining & Smelting Co., engineering department, and assistant secretary Tri-State Zinc and Lead Ore Producers Association, Miami, Okla.

Edward W. Bauman, Technical Advisor for Non-Metallic Mines, formerly highway materials engineer, Republic Steel Corporation, Cleveland, Ohio.

James E. Bacon, Assistant Technical Advisor for Non-Metallic Mines, formerly project advisor, Rural Electrification Administration, Washington, D. C.

Dennis L. McElroy, Technical Advisor for Coal Priorities, formerly director of School of Mines, West Virginia University.

J. L. G. Weysser, Associate Technical Advisor for Coal Priorities, formerly assistant professor of mining engineering, University of Illinois.

William M. Wheeler, Assistant Technical Advisor for Coal Priorities, formerly sales engineer, Goodman Manufacturing Co., Pikeville, Ky.

Edward H. Rott, Technical Advisor for Mine Priorities, formerly geologist with Richmond Petroleum Co. in Colombia, South America.

Francis O. Hausserman, Assistant Technical Advisor for Mine Priorities, formerly vice-president, Benguet Consolidated Mining Co., Manila, Philippine Islands.

Lane W. Hildreth, Technical Advisor on Mining Machinery, formerly Washington representaive of North American Coal Corporation, Cleveland, Ohio, and Secretary of the Anthracite Institute.

Harry L. Egolf, Jr., Technical Advisor for Smelter Priorities, formerly engineer, Cerro de Pasco Copper Corporation, Oroya, Morococha, Peru.

TRI-STATE

Zinc Tailings Plants Being Enlarged

Evans-Wallower Zinc, Inc., plans to treat a large tonnage in field near Picher—Operators anxious to learn their position regarding the new production quotas

▶ Tailings re-treatment and expansion of these operations were of chief interest and concern to feature activities during February in the Tri-State district, as new mine development was more or less at a standstill awaiting definite establishment of premium-price quotas by the government on individual properties and the Federal set-up which will handle the application of the subsidy plan, with all its probable administrative complications in the local mining field.

▶ Production of zinc concentrates by tailing plants in the district declined sharply during the last half of last year, compared with the first six-month period of 1941, according to figures compiled in an annual bulletin released by the Tri-State Zinc and Lead Ore Producers Association. Plants re-treating tailings produced 47,026 tons of blende during the first 26 weeks of the year, or an average of 1,809 tons weekly, as against a total of 37,847 tons, or an average of 1,402 tons each week, for the last 27 weeks of 1941. Total production of 84,873 tons by tailing mills during the 53 weeks of 1941 compared with 78,995 tons for the 52 weeks of 1940, or an increase of 5,878 tons during last year. The gain in output was due to increased plant capacity in 1940 and some improvement in price during 1941. Unless a better price, premium or otherwise, is afforded to offset higher costs of handling thinner tailing reserves, re-treatment operations are expected to taper off more rapidly this year. However, recent developments in tailings activities are expected to take up much of the slack in the trend outlined.

▶ A lease to re-treat about 3,000,000 tons of tailings on the old Golden Rod, or Evans-Wallower, lease between Picher and Cardin has been assigned by Mrs. L. L. Cardin, of Baxter Springs, to the Evans-Wallower Zinc, Inc., according to Floyd W. Gooch, of Joplin, company manager. The tailings to be re-treated are considered to comprise some of the richest known reserves remaining in the Picher field. The company will install new equipment costing approximately $50,000.

▶ Operations were resumed at the turn of the year at the Chitwood tailing plant of the Missouri Mining Co., a subsidiary of Tri-State Zinc, Inc., and now the latter firm is completing a new type of plant for the re-treatment of tailings at its Sooner tailing mill, in the northeast part of Picher, according to M. H. Loveman, of Joplin, district manager. The new plant will feature the second installation of the H-H sink-and-float process of ore dressing in the United States, and will have a larger capacity than the initial one installed by the Bunker Hill & Sullivan Mining & Concentrating Co. in its mill at Kellogg, Idaho. Capacity of the Sooner mill will be increased to 3,200 tons of tailings daily, of which approximately 2,000 tons will be handled over the new plant. All minus-8-mesh feed will be handled over the old flowsheet of the mill and the oversize will go through the new processing plant, Loveman said. With no delay in obtaining equipment, the plant is expected to be ready for operation in May, according to Loveman. "We eventu-

ally hope to re-treat re-run tailings, or those that already have been treated once," he added. In the flotation department, the additional thickener will supplement a 60-ft. one, and two Butchart float machines will be added to supplement the present 12-cell Denver Sub-A equipment. The new mill was designed by Gooch, assisted by C. E. Stover, of Miami, company engineer. Harold Holt and Melvin Perry, both of Cardin, will be general mill foreman and construction foreman, respectively, and Ray Baker, also of Cardin, will be master mechanic and electrician.

▶ The M. & W. Mining Co. has moved a derrick and 300-ton hopper from the south field shaft on the old Evans-Wallower No. 24 lease, northeast of Picher, in Kansas, to the north Huttig mill shaft, a mile west of Hockerville, according to I. W. Andrews, of Joplin, mine superintendent for the company. The old Huttig mine was dewatered recently to a depth of 253 ft., where mine operations will be carried on. Ore will be trucked to the Bilharz-Brewster mill, northwest of Baxter Springs.

▶ Clarence Zuvekas, of Joplin, has leased the old Lavrion mine, on the Ramage land, west of Douthat, to John Lewellen, of Picher. The lease includes the use of the old Lavrion mill derrick and 300-ton hopper on the adjoining Admiralty lease. Ore will be trucked to the Royal custom mill of the United Zinc Smelting Corp., southeast of Picher, for treatment.

▶ American Development Co. has started churn-drill prospecting for zinc and lead ore deposits on 1,000 acres leased in an area 7 miles northwest of Baxter Springs. W. T. Landrum and Dewey Simms, both of Baxter Springs, are interested in the company.

▶ Bilharz Mining Co. has started mine operations at its No. 3 Brewster mine, a mile northwest of Baxter Springs, where the company recently completed the dewatering of the ground and the construction of a large derrick and 500-ton hopper. Mine operations are being conducted on the 225-ft. level, and ore is being trucked to the Bilharz-Brewster mill, a short distance to the northeast, for treatment. J. L. Scott, of Baxter Springs, is mine superintendent and Wayne Ballinger, also of Baxter Springs, is mine superintendent. With the dewatering of the lower levels around a depth of 250 ft., the company is making preparations to expand mine operations further on the Brewster land, old underground workings of which were dewatered after extensive and costly pumping operations over a period of many months.

Copper and Zinc Branches Split

THE OLD COPPER AND ZINC BRANCH of the Materials Division of the War Production Board has been split into two new branches, one to handle copper, the other to handle zinc. This move was made because both production and allocation were handled by the same group of men and the amount of work became too great for a single staff.

The Copper Branch is headed by Harry O. King, formerly administrator of the

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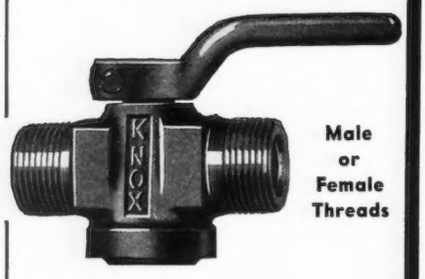

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NRA copper code and president of Munson Lines, Inc. David A. Uebelacker, who was the chief of the combined branch, is now charged with the formation of the Zinc Branch, of which he is the chief. Most of the personnel of the old combined branch stays with the new Copper Branch. Frank A. Ayer, chief of production in the old organization, retains the same position in the Copper Branch and also is Assistant Branch Chief. Other assistants to Mr. King are George G. Knox and John Church one-time chief of the combined branch and more recently consultant to Mr. Uebelacker.

The Zinc Branch, which is being formed by D. A. Uebelacker, starts off with a nucleus of five men about whom an adequate staff is being built rapidly. George C. Heikes is Assistant Branch Chief. The Production Section is headed by W. C. Page, with Percy Butler assisting. The Allocation and Priorities Section is being handled by Myron L. Trilsch, Chief, and Alfred H. Meuche.

Priorities Order P-56 For Operators Amended

FOR uninterupted and expanded operations of base-metal mines, the War Production Board has amended order P-56, effective March 2, 1942. This move places the mining industry on a par with manufacturers of leading war materials.

One important change concerns mines where 30 percent or more of the value of the output consists of gold and/or silver. Such a property is no longer entitled to use the ratings assigned by the order and its serial number will be withdrawn. It is suggested, however, that gold and silver mining companies which wish to retain their serial numbers should report 1941 gold and silver output together with production of any other war metals (quantity and gross value) to Dr. Wilber A. Nelson, War Production Branch, Tempo E, 6th and Adams Drive, S. W. Washington, D. C.

The amended order states that ratings are given for the purpose to maintain or increase output but not primarily to reduce operating costs.

The A-1-a rating remains unchanged covering equipment needed to repair breakdown or suspension of operations because of damage, destruction or failure of machinery. An A-1-c rating is now provided for repair parts for equipment listed in Schedule A (see *E.&M.J*, Dec. 1941 p. 97). The Mining Branch may recommend and the Director of Industry Operations may grant whatever priority ratings are required to insure delivery of equipment and machinery even if not listed in Schedule A. Each request, however, must be submitted for specific approval by the Mining Branch.

The Old A-3 rating formarly providing for repairs and new equipment in discontinued. All repairs and maintenance not covered by A-1-a or A-1-c is provided for in an A-8 rating. A-1-c applies to repairs, maintenance and operating supplies not directly connected with production.

One of the most important changes concerns delivery of materials (or physically incorporated into material to be delivered) to an operator under any preference rating assigned to him. An A-1-a, A-1-c or other rating given the mine operator may be extended to the supply house of the manufacturer to his respective source of supply, thereby speeding movement of supplies and equipment.

New Magnesium and Aluminum Production

LARGE-SCALE PRODUCTION of magnesium from two ferrosilicon processes has been decided upon by the War Production Board both as a means of minimizing dependency upon electric process power and to step up the national output sooner. This was announced at the end of February by Materials Director W. L. Batt in disclosing that to meet the President's war-production goals aluminum capacity is being stepped up to 1,050,000 tons and magnesium to 725,000,000 lb. annually, with the deadline set for early 1943.

The increase in aluminum production over previous goals is 640,000,000 lbs., virtually all of which is to be located in metropolitan centers using high-cost steam-power reserve capacities. Exact sites had not been selected early in March, but New York, Philadelphia, and Boston seemed assured of large plants.

The increase in the magnesium sights is 325,000,000 lb., nearly doubling the previous goal which in itself was more than ten times pre-war output. Six contracts for producing 175,000,000 lbs. of magnesium by an improved Pidgeon and the Union Carbide and Carbon ferrosilicon processes and 36,000,000 lbs. by the standard electrolytic process had been signed at the first of March. In addition to Union Carbide, other operators will be American Metals Co., National Lead Co., Ford Motor Co., Permanente Corp., and New England Lime Co.

Both the ferrosilicon processes to be utilized carry the endorsement of the National Academy of Sciences and both are independent industrial developments, Mr. Batt emphasied. The Materials Director pointedly omitted any mention of Secretary Ickes' recent claims of being able to produce the metal from Government-developed extraction methods.

In addition to the alumina and aluminum plant program, with the necessary fabricating facilities, the plan contemplates construction of new plants to produce synthetic cryolite and aluminum fluoride. These operations will be of sufficient magnitude as to make America completely independent of imports of the real materials.

A large portion of the new construction, particularly aluminum—is admittedly in the "white elephant" economic classification in so far as post-war operation is concerned—this being particularly true of the aluminum works in high-cost power areas. In admitting this, Mr. Batt pointed out that WPB's requirments committee has now formally adopted the policy which has been followed for some time by the Government in war production—that of counting dollar costs secondary to the amount of materials involved and the time required.

CANADA

Manganese Production Under Way in New Brunswick

Ore is treated in 100-ton concentrating plant—Kirkland Lake labor strike is over, with great loss to all concerned

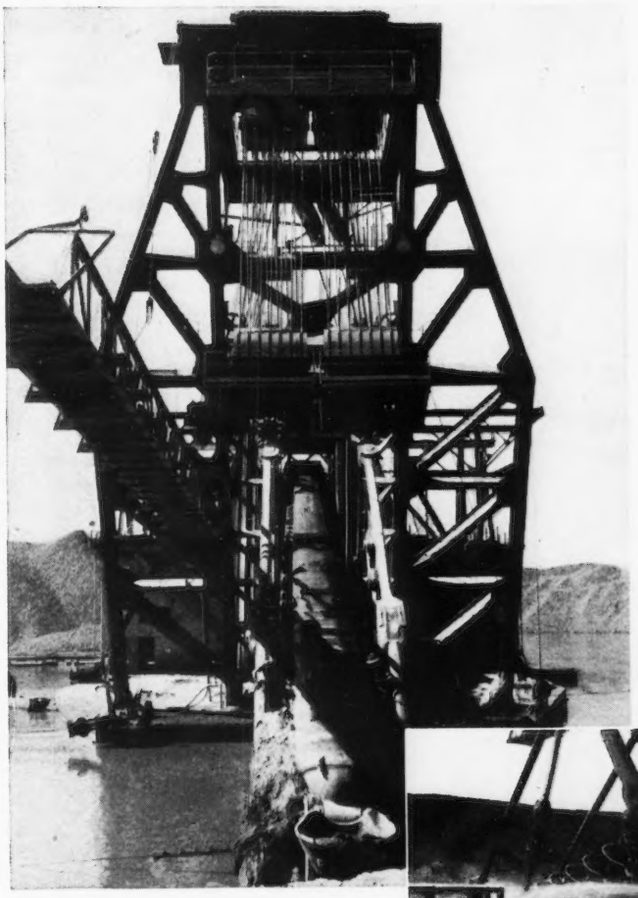
▶ The first commercial shipment of Canadian manganese in recent years was made in February, when the Nabco Manganese Mining Co. consigned five carloads from its property in New Brunswick to a ferromanganese plant in Ontario. Regular shipments from the 100-ton concentrator are expected in future.

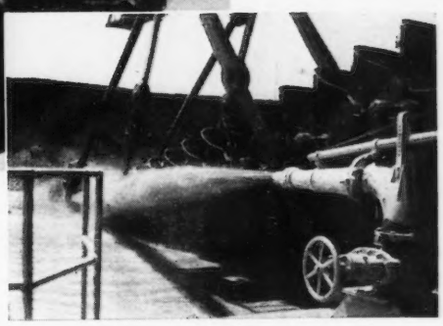
▶ The Kirkland Lake strike, called against eight gold mines on Nov. 18 by the C.I.O. Kirkland Lake Mine, Mill and Smelter Workers' Union, Local 240, was officially declared to be over Feb. 11. In calling off the strike the union stated "With the primary issue of union recognition still unsettled, this action is taken in the interests of national unity of the Canadian nation in time of war." This represents the greatest setback the C.I.O. organization has suffered in Canada. The strike has been generally recognized as a blunder perpetrated by irresponsible outside agitators whose only motive was the closed shop and the check-off for high union dues. In three months the whole community has suffered very substantial loss, several mines have reduced dividends as a result of lower output, which may never regain the rate prevailing before the strike, and the town has lost possibly as much as 15 percent of its population. Before the strike ended, mine operators established collective bargaining, with the men employed electing their own committees by secret ballot. This was in line with recommendations made last summer by the Industrial Disputes Inquiry Commission, headed by the Hon. Humphrey Mitchell, the present Minister of Labor. Employer-employee grievances are being successfully handled and other questions in connection with reemployment of strikers without discrimination can be considered by these committees.

▶ Hon. C. D. Howe, Minister of Munitions, formally opened the $600,000,000 Victory Loan drive in the Sudbury district with a solemn warning: "We have in Canada a great aluminum industry and we've multiplied that industry by five since the war started and are still adding to its facilities. Some time ago an unfortunate difference between management and employees resulted in the shutdown of that industry for five days. That resulted in the slowing down of airplane production in England to a very considerable extent and greatly reduced the stockpiles in the United States. If anything should happen to interrupt the production of nickel in the City of Sudbury, the whole character of the war will be changed."

▶ Premium prices to be paid certain United States producers of base metals under the quota system have not been made available to operators in Canada.

FOR DREDGEMEN





Above—Front end, Y.C.G.F. No. 20, with digging ladder raised for inspection and greasing.

Right—Eight inch monitor used primarily for knocking down high banks is also used to clean ladder and bucket-line on No. 20 for inspection.

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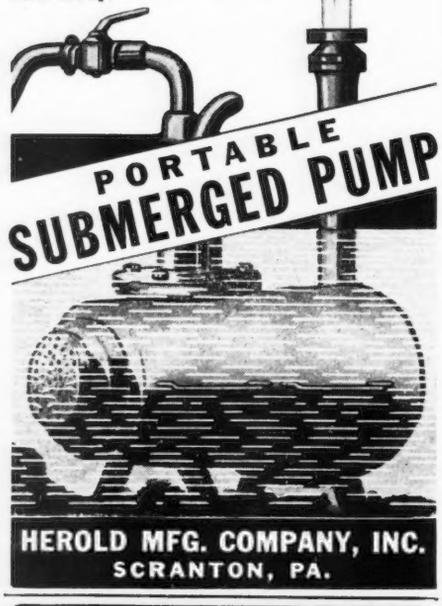

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A clean-up in the deep sluice box of the Lowhee Mining Co., Ltd., in British Columbia, Canada

▶ CANADA

Base Metals Mining Corp., Normetal, and Waite Amulet mines are shipping zinc concentrates to the United States market for sale at current prices plus the premium on American funds. Calumet Island, Golden Manitou, and Sherritt Gordon have also contracted with the Metals Reserve Co. to start zinc shipments as soon as new plant equipment is in operation. By far the greater part of the zinc and lead produced in the Dominion is being sold to the British and Canadian governments at 3½¢ per pound. Canadian copper continues to be sold at 10¢ a pound, as compared with the United States price range of 13.2¢ to 18.7¢ a pound in Canadian funds.

▶ The six deposits of iron ore discovered by the Labrador Mining & Exploration Co. in 1936 and 1937 are to be given further attention this summer by Hollinger Consolidated Gold Mines. It is reported that railroad construction would be undertaken by the Canadian National Railways, connecting the year-round port of Seven Islands with the Sawyer Lake deposit, 284 miles north of the Gulf of St. Lawrence. It is estimated that 2,200,000 tons of 65 percent ore per 100 ft. of depth is available at this one location. The phosphorous content is under 0.04 percent. Four other deposits are of good grade and one of them is rich in manganese. The other deposit is high in silica and is believed to represent a very large tonnage. Field work this year is to continue under the personal supervision of Dr. Joseph A. Retty.

▶ An Order-in-Council affecting imports of ultra-violet lamps used in detecting tungsten minerals has removed all duties, including the 10 percent war exchange tax and the 8 percent Federal sales tax. The lower cost of this instrument is expected to stimulate its use by prospectors and mining companies. Canadian tungsten output is being derived as a byproduct of gold ore in Ontario and the Northwest Territories, as well as from tungsten properties in British Columbia and Yukon. Metallurgical problems have retarded the recovery of a large tungsten content in the ore of Slave Lake Gold Mines.

ONTARIO

▶ Nickel Offsets, at Chelmsford, has opened a 13-ft. width of massive mineralization in preliminary work opening up the new 350-ft. level. Nearby diamond-drill holes disclosed a grade of 4 percent nickel and 2 percent copper, for true widths of 13 and 20 ft. James W. Baker is consulting engineer and Walter Riddell is mine manager.

▶ Dominion Magnesium is building a $3,000,000 plant near Renfrew with a capacity rated at 10 tons daily, five times the scale first planned. Funds are being advanced by the Ministry of Munitions and Supply. Magnesium is to be recovered by the Pidgeon process from dolomite. Robert J. Jowsey is president of the new company.

QUEBEC

▶ A preliminary report published by the Quebec Bureau of Mines gives $97,000,000 as the value of mineral output in the province in 1941, an increase of $13,600,000 over the previous year.

BRITISH COLUMBIA

▶ Directors of Mount Zeballos Gold Mines, Ltd., have announced: "Conditions at the mine for the past few months have been such that further exploration work is not felt to be justified, and steps are now being taken to remove the balance of the ore in the mine, which will take approximately two months, and the affairs of the company will then be wound up."

▶ The new mill of Musketeer Mines, Ltd., turned over for the first time on Jan. 9, when a limited tonnage was treated. Adjustments and alterations have delayed the commencement of steady production. The Musketeer operation is financed jointly by Pioneer Gold Mines of B. C., Ltd., and Anglo-Huronian, Ltd., and is the second property to come into production in the Bedwell River area. Buccaneer Mines, Ltd., wholly-owned Bralorne subsidiary, commenced regular production in August of last year.

▶ The closing of operations by Bulolo Gold Dredging, Ltd., as the result of enemy action in the New Guinea area of the Pacific, has led to the suspension of activity by Canadian Exploration, Ltd., the Canadian subsidiary of Placer Development, Ltd., of which Bulolo is also a subsidiary. Canadian Exploration had been particularly attentive to British Columbia.

▶ The Mining Committee of the British Columbia Legislature has recommended the establishment of the right of appeal from the rulings of the Superintendent of Brokers. The report follows: "Your committee, in view of the criticism of the 'Securities Act,' thought it advisable to investigate it. This was done by calling before the committee witnesses who had been complaining that the Act was a hindrance to prospectors and mining development in general. Twelve witnesses were called who gave evidence for and against the Act. After fully considering this evidence, your committee feels that it has not had enough time nor the opportunity to hear as much evidence on this subject as it should to justify any recommendation other than the repeal of subsection (4), section 10, of the Act. Your committee also feels that more publicity should be given to the purposes of the 'Securities Act' and its aims in connection with the mining industry; and that further study be given this matter during the interval and submitted with recommendations at the next Session of the Legislature."

MEXICO

Trend of Mineral Output Is Downward

Exports of raw materials also decline—Prospect of higher price for antimony held encouraging in an otherwise obscure outlook for the mining industry

▶ This is a tough winter for mining in Mexico. Production has dropped sharply and exports are about at a new low, with the United States almost the only buyer of Mexican metals and minerals. The outlook for the industry is none too cheerful, for there is no immediate prospect of conditions improving. The United States is buying less in quantity and number of Mexican mining products than in the recent past. Mercury, which last spring and summer popped up as an important factor in Mexican mining, has slumped both in production and export. Several companies have had to quit because work is unprofitable. Labor troubles continue, though government efforts are keeping this bother of the business under a certain control.

▶ Government circles are counting on a big upswing in antimony business for Mexico, with the war elimination of China as the chief purveyor of the mineral to the United States. Antimony prices are also expected to increase. Mexico produced 12,267 metric tons of antimony in 1940, the most recent year for which official data are available.

▶ Provision of some kind of employment to keep them from becoming public

Crews get back to work quicker after blasting when *Genuine Flexipipe* ventilation clears away smoke and fumes. And they work better with fresh air Flexipiped to the face at which they are working. These are two reasons why *Genuine Flexipipe* steps up production.

Made of tough, specially woven and treated material, *Genuine Flexipipe* can take the hard knocks of every-day use. It is resistant to damage from gas, fungus growth, heat, acid and alkaline waters. *Genuine Flexipipe* comes in three grades.

Mail the coupon today for descriptive literature on *Genuine Flexipipe*.

EASY TO HANDLE! *Genuine Flexipipe* is easy to carry. 1000 feet, with blower equipment, can be loaded in one mine car.

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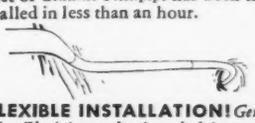

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The Original Flexible Ventilating Tubing

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Says an oil company worker: "A three man rivet buster was on one side of the tank, and I was on the other with a broom. The rivet head sheared off, glanced from the frame and hit my 'hard boiled' hat."

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Please send me new free folder describing: *"How to Select Head Protection at a Saving."*
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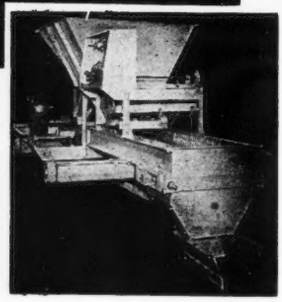

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Weighs Separately Regulates Separately

Ideal for weighing feed of ores to ball mills and other applications where control of feed improves efficiency. Continuously totalizes the weight. Gives better control of grind. Details on request.

BULLETIN 388 FOR DATA

MERRICK SCALE MFG. CO.
PASSAIC, NEW JERSEY, U.S.A.

▶MEXICO

charges is being sought by the Labor Ministry for the more than 200 miners who are chronic sufferers from silicosis. Most of these victims are in Guanajuato.

▶ Development of the Tepezala and Asientos mining zones, among the richest in Mexico, is assured, says a government statement, with the provision of 3,000,000 pesos ($615,000) to complete building of a road in Aguascalientes, 147 km. long, between Aguascalientes City, Ojuelo and Calvillo, and to connect with the Mexico City-El Paso, Texas, Highway. These mining zones have been more or less dormant because of the lack of adequate transportation facilities. The Aguascalientes road is scheduled to be in service by the end of 1942.

▶ Chihuahua and Coahuila are exerting great efforts to advance mining. The Chihuahua government is arranging for resumption of work, suspended some time ago because it was unprofitable, by Cia. Minera San Carlos, S. A., Ojinaga. The state of Coahuila has made available 500,000 pesos ($105,000) to condition mines at La Conquista and Las Esperanzas for work and has intervened to settle a labor dispute that disrupted these operations. The Coahuila government has appointed Congressman Santiago Aguirre to represent it in straightening out this dispute. Lic. F. A. Lopez Serrano, secretary general of Coahuila, announced that an unnamed American company is interested in establishing an iron and steel foundry, with two blast furnaces, at Monclova, and that this deal is expected to be consummated in the late winter.

▶ Workers of Cia. Minera y Exploradora del Amparo, S. A., Etzatlan, Jalisco, have been ordered by the labor ministry to continue working when it ascertained that they have no reason for striking, because they are well paid and are receiving their wages on time and in full and that the company is being satisfactorily managed. The ministry has also averted a strike against Cia. Minera La Victoria, S. A., Cosala, Sinaloa, by inducing the workers to accept arbitration of their dispute, arising from objection to the company's request that personnel and pay be reduced because of an economic depression.

▶ The ministry and the Chihuahua government are arranging financial aid for the mining cooperative society that is in charge of properties of Cia. Minera Los Azules, S. A., Mineral Los Azules, which is again in difficulties because it has had its electric services suspended. The society owes the power company for two weeks' services. Last year, this society had to suspend work for some time because power was shut off due to failure to pay bills. Official money is counted on to assure steady power for this society.

▶ As part of its social modernization program, the national miners' union has started free instruction in English of all members of its Section IV, Nueva Rosita, Coahuila, site of the Mexican Zinc and Cia. Carbonifera de Sabinas, S. A., the latter a coal mining enterprise. Prof. Pablo T. Gloria is teaching these miners English. The union expects soon to extend this instruction to several other of its sections. The Nueva Rosita units are A. S. & R. subsidiaries.

SOUTH AMERICA

Copper Mines Will Receive More Equipment

Preference rating order P-58 stipulates greater deliveries until April 1, 1943—United States has agreement to buy Chile's strategic minerals

▶ Copper mines in South America, which have been securing stipulated amounts of maintenance and operating supplies with the assistance of Preference Rating Order P-58, will benefit to a wider extent by the terms of an amendment, announced Feb. 14, by the Division of Industry Operations. The A-1-d rating, provided for in the order, was previously applicable to purchases of maintenance and operating materials to be delivered before July 1, 1942, in amounts limited to the same quantities as were shipped to the mines from the United States between April 1 and Sept. 30, 1941. It may now be used to expedite material to an amount double that shipped during the base period. The A-3 rating, assigned by the order to deliveries to be made between June 30 and Oct. 1 of this year, may still be used to expedite such shipments, and the total of goods which may be acquired with the assistance of both ratings is now three times that shipped during the base period. In addition, the amendment extends the order to April 1, 1943. It would otherwise have expired on Sept. 30 of this year.

CHILE

The Government of Chile announced Jan. 29 that it has entered into an agreement which gives to the United States exclusive buying rights on all strategic minerals produced in Chile. The accord covers a period of 18 months. Prices to be paid and tonnages involved are subject to review every six months. Items mentioned in the agreement are: Copper, gold, manganese, quicksilver, lead, zinc, antimony, tungsten, molybdenum, and cobalt. The agreement does not disturb existing contracts for copper between Metals Reserve and the large copper producers.

Exports of copper by Chile during the years 1940 and 1941, in short tons, excluding a small tonnage exported as ore or concentrate:

	1940	1941
Electrolytic:		
United States	172,631	230,825
Argentina	3,088	11,298
Brazil	.....	8,858
Italy	6,746	.....
Japan	15,939	14,077
Other countries	1,550	288
Totals	199,954	265,326
Standard:		
United States	175,934	215,807
France	3,080	.....
Italy	13,216	.....
Sweden	1,205	.....
Japan	.....	3,729
Undistributed	138	.....
Totals	193,573	219,536
Grand totals	393,527	484,862

AFRICA

Taxation Retarding New Development on Rand

Activity continues, however, in Western Rand, where the Carbon Leader of Blyvooruitzicht maintains its persistence in depth and richness

▶ George H. Beatty, consulting engineer, said at a Johannesburg Consolidated meeting that the present rate of South African taxation makes it unprofitable to develop new Witwatersrand mines. His statement has provoked wide and animated discussion. But it seems that Mr. Beatty was considering only the development of the deep areas, below the bottoms of the present producing mines. There has been some doubt as to the advisibility of attempting to open new mines where it is necessary to begin by sinking shafts 7,000 to 9,000 ft., regardless of taxation. The new mines in the far western Witwatersrand area are either well on their way to development, or are producing, and those producing are doing particularly well. Orange Free State discoveries do not call for very deep sinking—a maximum of perhaps 4,000 to 6,000 ft. But if the productive life of the Witwatersrand is to be greatly prolonged it will become necessary to open up the deep ores, and this is not likely to be undertaken without some guarantee of protection against confiscatory taxation. Because of the matter receiving so much attention, a reform of South African taxation will probably occur after the war.

▶ Blyvooruitzicht developments seem to have set up a record for continuity of mineralization as well as for richness. It was stated at the annual meeting that total openings on the reef, 1,850 ft., were all in pay ore averaging 65.0 dwt. per ton over widths averaging 14.3 in. The reef called the Carbon Leader was cut at a depth of 4,685 ft. It dips south at an angle of about 20 deg. The company has so far expended £1,962,026, and net quick in hand June 30 was £487,974. Work on the erection of the first unit of its mill, which will treat 8,000 tons of ore monthly, is already in hand. The profit arising from the operation of this unit will be used wholly for development.

▶ West Witwatersrand Areas plans to form a third subsidiary, it is now announced officially, as soon as conditions warrant and permission is granted to offer shares in the London market. It will be the West Driefontein area already proved by drilling. Of the two subsidiaries already floated the Venterspost is already a dividend payer. The other, Libanon, has been handicapped so far by broken ground in which results have been rather indifferent, but they are now approaching an area in which diamond drills disclosed excellent values. West Witwatersrand has a considerable interest in Blyvooruitzicht. Evidently with the idea of being in position to supply any capital requirements that may arise in connection with these companies, West Witwatersrand will not pay a dividend but will conserve the dividends it is receiving from Venterspost.

Why continue to cut and bow wire rope, weakening the strands, making serious accident possible?

Use the Safety Clip. It can't be put on wrong — inexperienced workers can't cause the dangers of the U-Bolt put on backward. The Safety Clip takes a powerful, all-round Fist-Grip on rope. The four flat bearing surfaces far out-hold the finger-pinching U-Bolt Clip, and cannot crush and crimp wire rope.

The Safety Clip Gives More Steel for Armaments!

25% less steel is used in a Safety Clip assembly equal in strength to a U-Bolt-held rope. That steel can go to arsenals and plane factories for all-out military needs. Fewer clips are needed — that saves steel, too. And the rope-ends stay straight and round for re-use — no expensive waste from cut-off crimped-up rope ends.

THESE ARE YOUR SAFETY SAVINGS

No rope crimping or bowing	rope saved
No special wrench	tools saved
Bolts on opposite sides	tightening time saved
Can't go on wrong	accidents saved
Fewer clips needed	clips saved
Fewer rope breaks	accidents saved
No bent, battered threads	clips saved

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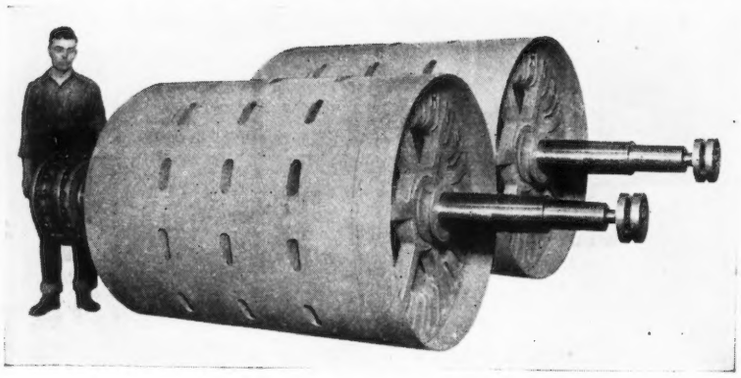

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AUSTRALIA

Steady Output Of Copper in Tasmania

Mining being conducted on a greater scale—Wiluna Gold Mines, Ltd., takes option on Mt. Charlotte group of leases

▶ The Commonwealth's largest copper producer, Mt. Lyell Mining & Railway Co., earned a net profit of £A169,318 in the financial year to Sept. 30, 1941, after providing for development, depreciation, and taxation. Owing to war-time regulations, information on production is not available. Mining and milling were carried out on an increased scale. The grade of ore treated was slightly lower and metal recovery was somewhat reduced in consequence.

WESTERN AUSTRALIA

▶ The most interesting recent development in Western Australian mining is the option taken by Wiluna Gold Mines, Ltd., over the Mt. Charlotte group of leases at Kalgoorlie. The Mt. Charlotte area comprises 60 acres and is close to the centre of the city of Kalgoorlie, near the site of the first discovery of gold on the field. With the assistance of the Western Australian government the Mt. Charlotte Co. was making arrangements for the equipment and working of the mine, under the management of the Paringa company, prior to the arrangement of the present option.

▶ One of the successful small mines of the State, First Hit Gold Mines (1934), N. L., seems about to finish its career at the shallow depth peculiar to the Menzies field.

VICTORIA

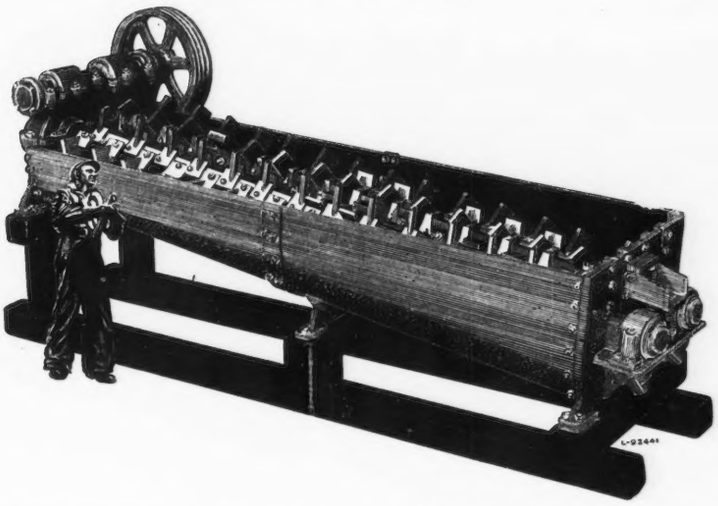
▶ For some years past, excellent work has been done by a number of companies in the recovery of gold from dumps of slum, or slime. Many such dumps have resulted from the working of the extensive systems of deep alluvial leads, the wash from which was puddled and passed through sluice boxes. The gold in the granular part of the wash dirt was readily recovered, so that the sands dumped from the sluice boxes are practically valueless, but very fine gold went out with the slimes, and it is these dumps which have yielded very satisfactory returns in recent years. The usual methods of treatment adopted are the sluicing and pumping of the dump material to the plants, followed by agitation and filtration on Moore or Oliver filters.

NEW SOUTH WALES

▶ Increasing attention is being given to the possibilities of extension of the Broken Hill lode to north and south. At the southern end the work carried out by Zinc Corporation, Ltd., in the New Broken Hill Consolidated leases is gradually proving the continuation of the large orebody in a southerly direction at a depth approximating 3,000 ft. from surface.

EQUIPMENT NEWS

New Log Washer



"A DISINTEGRATOR consisting of a cylinder carrying knives or paddles and revolving in a trough, for separating ore from clay and earth, the detritus being washed away by a stream of water," is Webster's definition of a log washer. This is inserted merely to answer the question often asked, if a log washer washes logs. Interest in exploiting many types of mineral deposits which require clay removal from the ore has brought the log washer more into the limelight.

The first patent taken out on the log washer was believed to be by S. Thomas in 1856, known as the Thomas washer, for cleaning iron ore in Virginia. The wooden log was cut octagonal in shape with cast-iron paddles fastened to the log, usually by lagscrews. Later the Thomas washer was purchased by J. King McLanahan, who built log washers for washing clayey iron ores in Pennsylvania. About 1890 angle iron was first used to replace the wooden logs and use of the log washer became better known in the metal and non-metallic fields.

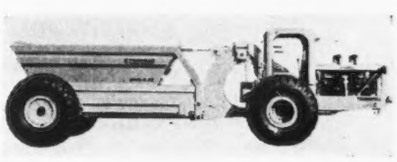
Advances have been made slowly, but today manufacturers of log washers are offering substantial units, meeting the capacity and treatment problems of present-day needs. One of the latest announcements covering this type of equipment was made recently by the Pennsylvania Crusher Co., 1704 Liberty Trust Bldg., Philadelphia, Pa. The washers are made in varying lengths from 16 to 30 ft., depending on the amount of clay to be washed from the ore. On the shorter washers paddles are 10 to 16 in. apart. The logs are square, being built up with iron plates and welded, and at the end of each log are gudgeons shafts permitting removal of the logs. Paddle design involves a cast base with paddles, each paddle securely held by bolts which pass through the log, holding a paddle on the opposite side. A feature of the paddle in the manufacturer's new unit is a patented scroop design which serves to pick up the materials, giving the clay and material an opportunity to break up after it has passed the first 1/3 area of the washer. Two of these scroop paddles are supplied on each log and are interchangeable. Maximum size of feed is material that would pass a 4-in. ring. The average slope of the log is about 2 in. to the foot.

Another feature pointed out by the manufacture is the improved drive with SKF or self-aligning bearings at the driving end. The worm-gear drive is sealed in an oil bath with rawhide oil seals to prevent oil leaking into the box or washing chamber. The worm gears permit use of a higher-speed motor, and, being totally inclosed, any hazards to operators are reduced. Placing of the V-belt drive is optional, on either side. The washed ore is discharged from a small chute seen directly below the inclosed bearing on the right-hand end shown in the cut. The chute above the inclosed bearing is the clayey water discharge.

New Hauling Unit

TO UTILIZE FULLY the power and speed of the Super C Tournapull, R. G. LeTourneau, Inc., Peoria, Ill., recently introduced its W210 Tournatrailer with a heaped capacity of 17 cu.yd. This unit has been designed with flared side and end walls to give the bowl an 8 in. by 12 ft. 8 in. opening at the top for quick, accurate loading by big dragline or shovel. The machine is powered by the 150-hp. Super C Tournapull for fast pickup and travel, quick spotting, and maneuvering. Four forward speeds: 2.6, 4.4, 8.1, and 14.3 m.p.h., and reverse 2.2 m.p.h., give travel speeds for all job conditions.

Among features listed by the manufacturer are: patented, self-cleaning, sliding bowl that gives end-dumping or spreading in layers from an inch to 36½ in. in depth; and 21-in. external hydraulic brakes, lined with 300 sq. in. of woven braking surface for positive stopping.

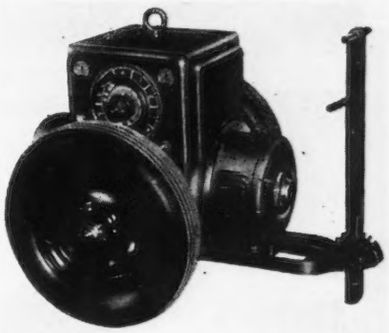


Blackout Paint

A BLACKOUT PAINT said to meet all the requirements for ease of application, obscuring of light and reflections, simplicity of removal and economy has been announced by Midland Paint & Varnish Co. of Cleveland, Ohio. This new formula, known as Midland P-40 blackout paint, has been made for outside application. The inside painting of glass is not recommended, as light reflections and halations would still be visible even for long distances. Reports from aviators indicate that even moonlight reflected from glass provides guides for bombing raids. The paint is said to dry rapidly (30 to 40 min.) to a self-leveling, dull, flat surface that inhibits reflections or halations. It can be brushed on or thinned with proper solvent to spraying consistency. Average area covered 550 sq.ft. to the gallon.

Portable Welder

A NEW two-wheeled, lightweight, pneumatic-tired trailer for mounting 200, 300, 400 amp. Hobart electric-drive welders is announced by Hobart Brothers Co., Troy, Ohio. Designed for road towing



up to 35 miles per hour, this unit will prove very useful for hurry-up trips to different locations for emergency production, maintenance, and repair work. Trailer is so designed that mounting it is accomplished easily by means of three bolts in the frame of the trailer which register with three holes in the legs of the welding machine. The unit is easily moved by hand and measures 54 in. long, 45 in. wide, 27 in. high (over tires), and 13-in. axle center.

Testing Rail Bonds

A NEW two-in-one instrument for testing efficiency of rail bonding in coal-mine track systems has just been introduced by the Mosebach Electric & Supply Co., 1153 Arlington Ave., Pittsburgh, Pa. In addition to determining power losses through rail bonds, the instrument also enables operators to ascertain voltage decrease at any point in the line. Operation is said to be simple and is accomplished by one man. Size of the instrument is approximately 8x6x4½ in. and its weight is only 3½ lb.

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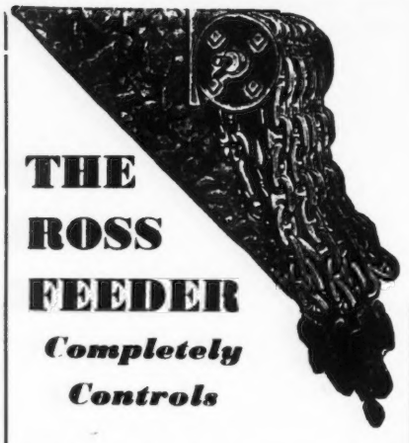

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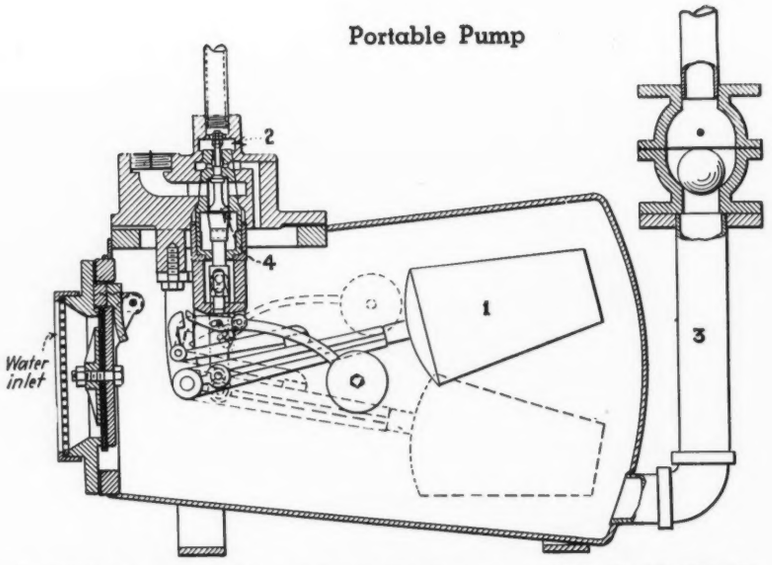
Portable Pump



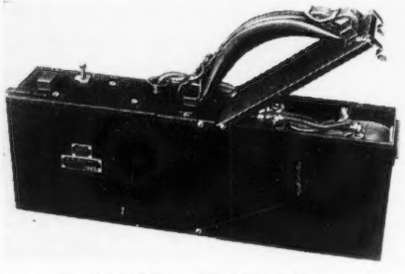
A portable pump for submerged operation is announced by Herold Mfg. Co., Scranton, Pa. As indicated in the drawing above, the water enters through the water inlet, lifts the float valve, 1, which in its highest position opens the compressed-air valve, 2. The air compressed as discharged forces the water through the water outlet pipe, 3. The float in turn recedes with the sinking water level, closes in its lowest position the compressed air valve 2, and opens the air discharge valve 4, and the water again can float into the pump. When there is no floating the compressed air automatically is shut off.

Power Chain Saw

A new power chain saw operated by an air or electric motor is announced by Henry Disston & Sons Inc., Philadelphia, Pa. The rotary air motor is rated at 1½ hp. (90 cu.ft. of air at 90-lb. pressure), and the electric universal motors a.c. or d.c. are for 110 or 220 volts, 60 cycles. Above is shown a 24-in. air-operated chain saw used to prepare mine timber.

Prospectors Ultra-Violet Ray Lamp

A NEW MODEL of Mineralight the ultra violet ray black-light lamp, useful for instantly identifying the valuable tungsten ore scheelite and other minerals which also fluoresce under black light, is



announced by Ultra-Violet Products, Inc., 5205 Santa Monica Blvd., Los Angeles, Calif. Designed for use by prospectors, mineralogists, and collectors, the new model, No. 564, operates with a cell in a built-in compartment, and features a built-in regular flashlight in addition to the black-light lamp. A double contact switch enables the operator to use either type of light at will, thus permitting him to look carefully for likely indications with the regular light, and upon encountering them to check up at once with the black light.

The lamp weighs 7½ lb., including two 6-volt lantern batteries. Its high ultra-violet efficiency is such that it will detect scheelite as far as 10 ft. away.

New Mobiloader

ATHEY TRUSS WHEEL CO., 5631 W. 65th St., Chicago, Ill., announces its new Model 8 Mobiloader, which is powered by the "Caterpillar" D8 tractor. Com-

panion model is the W4 Mobiloader, which is being used on a wide variety of loading operations. Exhaustive tests for more than two years on actual operations in mines, quarries, on highway and earthmoving jobs, the manufacturer states, have proved the many advantages in speed and loading efficiency that the Model 8 Mobiloader offers. The unit digs at the front and dumps overhead to

the rear, employing the same principle as the W4 Mobiloader. With bucket capacities ranging from 2.7 to 9½ cu.yd. Depending on the type of materials to be handled, the unit loads earth, ore, sand, clay, coal, gravel, stone and many other materials.

CONSERVATION

Conservation of metals. A good example of special provision for collecting segregated scrap metals. Hawthorne Works, Western Electric Co., Chicago, Ill.

Smoke Alarm

PHOTOELECTRIC SMOKE-ALARM type A25C of Photoswitch Inc., Cambridge, Mass., is said to increase combustion efficiency by indicating the degree of smoke density, passing through the stack, and signaling conditions of efficient combustion and excess smoke on green and red signal lights. The equipment includes photoelectric control, light source, and indicator.

The photoelectric control and light source are mounted on opposite sides of the flue or stack. They are aligned so that the light beam projects to the eye of the photoelectric control. The design of the lens system mounting minimizes the possibility of soot and dust gathering on the lenses.

CUTTING MACHINE

The Airco "45", developed by Air Reduction, 60 E. 42d St., New York, N. Y., is a high speed machine cutting tip with divergent nozzle that makes short work of cutting out a semicircular piece from this 6-in. thick alloy-steel block.

Scrapers and Cableways

...for All Kinds of Long Haul Work

Above is a small Sauerman Drag Scraper hauling tailing away from a flotation plant onto a long pile extending across a ravine.

Here is a Sauerman machine moving crushed fines from an unloading chute out onto a wide storage pile at the rate of 200 tons per hour. The scraper bucket can be turned around in a few minutes' time to change from storing to reclaiming.

A complete list of the mining firms using SAUERMAN Scrapers and Cableways reads like a "Who's Who" of the industry.

Many of the larger companies are operating SAUERMAN Machines at a number of different locations, having found this equipment superior for a variety of dig-and-haul jobs.

Tailing piles are being reclaimed that couldn't be handled profitably by any other than the SAUERMAN method. Settling ponds are being cleaned, surplus ore stockpiled and reloaded, dams constructed, blasted ore moved from pit to cars and other similar problems solved at a saving.

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AND EQUIPMENT

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Metallurgical Testing and Field Consulting Service on Jigging, Flotation, Cyanidation and Placer Recovery Methods for Dredges and Doodlebugs.

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Information on the above services and equipment will be gladly sent on request.

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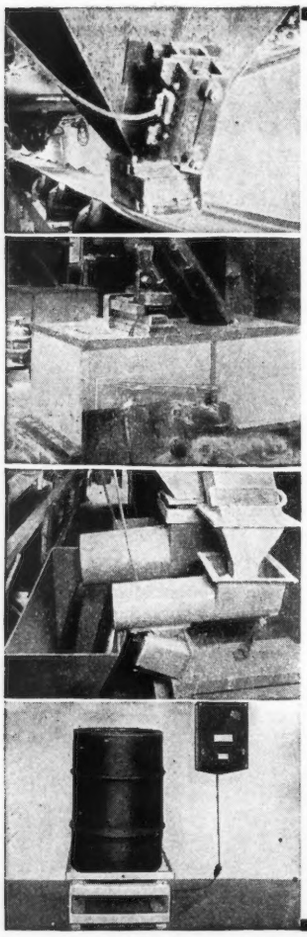
Cables: "Panco"

Design, Metallurgical Testing and Field Consulting Service; Manufacturers of Mill and Placer Recovery Equipment.



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MODERN METAL MINE OPERATORS RELY ON KOPPEL CARS

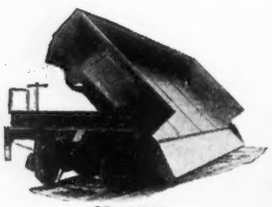
KOPPEL

HAUL MORE TONNAGE AT LESS COST!

HIGH PAY LOAD CAPACITY—QUICK CLEAN DUMPING ACTION—RUGGED DURABILITY—MINIMUM MAINTENANCE PER TON

When it's increased haulage you're looking for—with economical operation—then KOPPEL Industrial Cars are your best bet! These rugged, clean-dumping cars are engineered for speed, dependability and long life. They're built in over 75 types to give you the highest pay load capacity in all types of service.

WRITE for complete information on recommended types for your service. Request Bulletin No. 71.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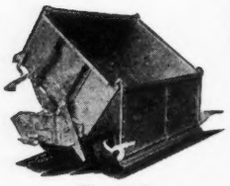
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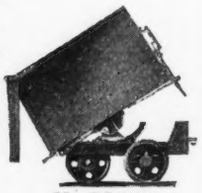
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No. 4194

PRESSED STEEL CAR CO., INC.
(KOPPEL DIVISION)
PITTSBURGH, PA.

Portable Searchlight Unit

LISTER-BLACKSTONE, Inc., Milwaukee, Wis., announces the manufacture of powerful, portable searchlight units, in addition to its regular floodlight machines. Like the floodlight model, the searchlight model is called the "Nite-Hawk" and is a fully self-contained source of light. It has a 24-in. searchlight with 3½ million candle power and is said to throw an effective beam of light for one mile. Two 30,000 candle-power, wide-angle floodlights are also mounted for use as auxiliary or general lighting.

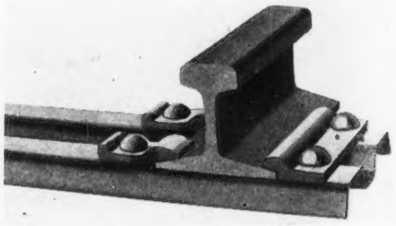
The unit is mounted on a two-wheel sprung frame and pneumatic tires, and is easily towed by an auto or small truck. A third retractable wheel allows unit to be wheeled easily into position by the operator. Power for both the searchlight model and the regular floodlight model is supplied by an air-cooled, 14 hp. Le Roi engine, equipped with an electric starter. A 5,000-watt self-regulating d.c. generator, connected to the engine, delivers direct current at 110 to 120 volts, the voltage being adjustable by means of a rheostat on the control panel.

Sweat Band

A new synthetic sponge sweatband 7½ in. long is offered by American Optical Co., Southbridge, Mass. This light-weight devise can be sterilized and used many times

Improved Steel Mine Tie

MECHANIZED mining equipment has caused mine operators to increase the weight of rail sections used in certain parts of a mine, in order to carry the heavy load of mechanical loaders and larger mine cars. To provide for this trend, Bethlehem Steel Co. recently announced a new tie, called the No. 5 Steel Mine Tie. In addition to its heavier and stronger section, the new tie has a sturdier clip and a larger rivet, to take care of the extra stresses imposed on



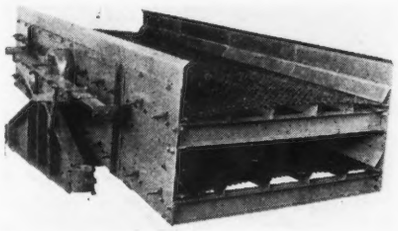
these parts by the heavier equipment. The principal dimensions of the new tie are as follows: Width, 5½ in. Weight per ft., 5 lb.

The sturdier clips used are ⅜ in. thick, compared with the $\frac{5}{16}$-in. clip section formerly used. The length of the clip body is also greater to accommodate a ⅝-in. diameter rivet with full-size head. The tie is recommended for use with 40-lb. rails, or wherever conditions demand a tie of greater strength and rigidity. It can also be furnished with proper size clip and rivet to accommodate 30-lb. rails.

Sponge Rubber

B. F. GOODRICH CO., Akron, Ohio, announces a new sponge rubber made from its synthetic rubber Ameripol. It is offered to fill requirements of a wide range of applications where oil, grease, or other solvents which deteriorate natural rubber are present. Tests are said to have proved the substance has extraordinary resistance to oils, greases, and many other solvents, and, as well, it withstands a higher degree of temperature than natural rubber.

Improved Vibrating Screen



Robins Conveyor & Belt Co., Passaic, N. J., announces its improved Gyrex screen having circle throw action. Some of the features pointed out by the manufacturer are simplicity of design, central vibrator location, and balanced stabilizing springs. A minimum number of easily accessable cloth attachment bolts permits speedy cloth changes.

For Determining Proper Temperature

THE TEMPIL CORP., 132 West 22d St., New York, N. Y., maker of thermometric pellets, announces a new, convenient form of their product, called Tempilstik. Tempilstiks, like Tempil pellets, have a specified melting point. They are available from 125 deg. F. to 1,600 deg. F., in convenient temperature intervals, and have a mean accuracy of within 1 percent of the temperature clearly stamped on each stick or pellet.

Thus a 300 Tempilstik, drawn across a surface heated to less than 300 deg. F., will leave a chalklike mark which melts sharply into a liquid streak when the surface reaches 300 deg. F. The new Tempilstik offers a means of leaving a temperature signal mark on less accessible places, such as vertical, inclined, and overhead surfaces. Properly used, each stick will yield up to 1,000 temperature determinations.

Increase QUICKSILVER Production

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Get maximum production from your Quicksilver operation—get it NOW—get it at lower operating costs.

Take advantage of GOULD'S 25 years of specialization in quicksilver plant design and operation. As operators of several of the largest quicksilver mines in the country, GOULD engineers are constantly testing, improving, checking and rechecking quicksilver recovery equipment and methods. GOULD can apply this wealth of experience to YOUR plant— and bring about higher percentage recoveries at minimum operating costs.

Put our experience to work for you. Let us recommend new methods—redesign your plant if necessary—or perhaps make slight modifications in equipment—that will augment your production.

Write TODAY for full information

Lowest Costs
Accurate Control
Individually Designed
Greatest Flexibility

MERCURY — ROTARY FURNACES AND CONDENSING SYSTEMS

H. W. GOULD & CO.
MILLS BUILDING
SAN FRANCISCO, CALIF.

WHEN PRODUCTION *hits Peak Plus*

You need plus-performance now from your air and gas handling equipment in flotation, agitation, or acid plant operations. This is the kind of service that Roots-Connersville Blowers and Exhausters deliver on really "tough jobs", as mining men know. Shipping schedules are based on "all out" Victors efforts, as we are working 24 hours a day, 7 days a week, to meet demands.

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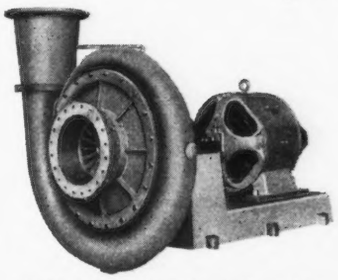
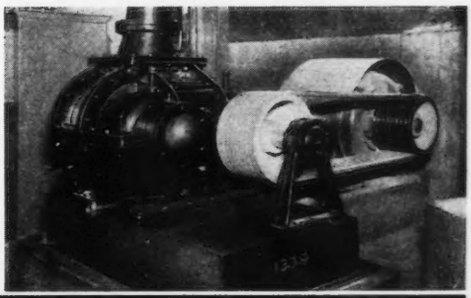


Single stage 20" Centrifugal Blower handling SO_2 gas for western smelting company. 10,500 CFM; 2 lbs. pressure.



Rotary Positive Blower used for agitation in Canadian gold mine. 1,299 CFM; 10½ lbs. pressure.

ALL OUT for VICTORY

Roots CONNERSVILLE SINCE 1854

Rotary Positive & Centrifugal AIR and GAS HANDLING EQUIPMENT

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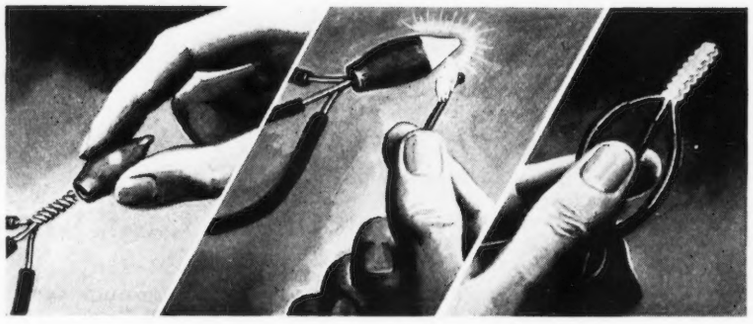
Novel Soldering Kit



A NEW QUICK-SOLDERING KIT is announced by Jiggers, Inc., 215 West Illinois St., Chicago, Ill. Each unit is a small, self-contained soldering unit that contains just the correct amount of 50–50 solder and flux hermetically sealed within a waterproof heat-generating outer shell. To obtain a strong, perfectly soldered electrical connection, it is only necessary to push the wire splice into a Jigger, as it is called, and touch a lighted match to the solder as shown in the photograph. The shell ignites and produces the proper temperature to flow the solder into the splice. The burnt shell is then dropped off and a smooth, perfectly soldered splice is revealed.

BULLETINS

Concentrating Tables. Deister Machine Co., 1933 E. Wayne St., Fort Wayne, Ind. Bulletin 28 describes and illustrates operating and construction features of its various Plat-O concentrating tables. Drawing of deck contours and installation arrangements and engineering data are given. Pp. 17.

Lubrication. Standard Oil Co. of Ind., Chicago, Ill. The company through its sales technique service department recently issued PT-111, entitled "Power Transmission Equipment and Its Lubrication." Pp. 51.

Carbon and Alloy Steel Bar Specifications. Joseph T. Ryerson & Son, Chicago, Ill., has issued a pamphlet comparing the two systems of steel identification, S.A.E. (Society of Automotive Engineers, Inc.) and A.I.S.I. (American Iron and Steel Institute). The book contains the latest data for both of these systems of identification, and complete analysis ranges for straight carbon and alloy steels of both systems are listed. The average physical properties are also given in their proper relationship. Pp. 23.

Decimal Equivalents. U. S. Rubber Co., Rockefeller Center, New York, N. Y. The company has issued a large handy pasteboard table of decimal equivalents from 1/64 to 1.

Meehanite Castings. Meehanite Research Institute of America, 311 Ross St., Pittsburgh, Pa. Bulletin 15 describes and illustrates Meehanite castings used in various types of defense equipment. Pp. 11.

Diesel Electric Sets. Caterpillar Tractor Co., Peoria, Ill. Form 6905 is a photographic brochure showing installations of the manufacturer's diesel electric sets for domestic and industrial use.

Hose Manual. U. S. Rubber Co., Mechanical Goods Division, Rockefeller Center, New York, N. Y. The manufacturer's hose for various industrial uses are shown in this manual by cut-away sectional drawings. Pp. 6.

High-Voltage Starters. General Electric Co., Schenectady, N. Y. GEA-3630 describes the design, construction, and application of the manufacturer's new 2300-v. contactor motor starter, which can be safely applied to high-capacity power circuits. Pp. 12.

Small Dust Controllers. Aget-Detroit Mfg. Co., 958 Book Bldg., Detroit, Mich. Folder describes and illustrates manufacturer's dust-collecting unit for use in connection with tool pedestal and bench and cutter grinders. Pp. 4.

Flow Alarm. Fred H. Schaub Engineering Co., Chicago, Ill. Leaflet describes the high- or low-pressure service on water, oil, gas, or air-line application when a signal is needed. Pp. 1.

Hydraulic Drives. Twin Disc Clutch Co., Racine, Wisc. Bulletin 132 describes the manufacturer's line of hydraulic drives for all types of service. Pp. 23.

Tool Steel. Jessop Steel Co., Washington, Pa. Bulletin 741 describes the manufacturer's carbon tool steel suitable for general tool purposes. Pp. 8.

Cement Guns. Cement Gun Co., Allentown, Pa. Bulletin 2200 describes and profusely illustrates the numerous uses of the company's cement guns employed in the practice of applying Gunite a sand-cement mixture on surfaces above and underground. The bulletin may be considered a very comprehensive textbook on all phases of the Gunite practice. Pp. 74.

the practical side of mining—**BY ATLAS**

FOR INTERMEDIATE MINE HAULAGE

Use the Atlas "Type K". It gives you the maximum in operating efficiency plus the minimum in maintenance costs. Incorporating the Atlas Spur Gear Drive, the "Type K" is of heavy duty construction throughout, to stand the strain of the continuous operation required in today's stepped-up mining schedules.

Write for detailed specifications.

THE ATLAS CAR & MFG. CO.
★ **CLEVELAND, OHIO, U. S. A.** ★

Belt Conveyors. Goodman Manufacturing Co., Halsted St. at 48th Place, Chicago, Ill. Bulletin C-411 describes and illustrates the manufacturer's belt conveyors for use underground. Pp. 23.

INDUSTRIAL NOTES

How to Instruct a Man on the Job is the title of Bulletin 2-c, issued by the Labor Division of WPB, Fourth St. and Independence Ave., S. W., Washington, D. C. It is especially prepared to help all those who instruct workers on the job, group leaders, sub-foremen, lead men, job setters, experienced workers. It is useful to all who direct the work of others, from foremen to managers.

The Mexico City Office of **Denver Equipment Co.**, previously in the Boker Building, is now situated in Edificio Jalisco, Calle Ejido No. 7, Mexico, D. F. **Santiago Soto** is in charge.

Anton Smit & Co., Inc., one of the country's largest importers of industrial diamonds and manufacturers of diamond tools, announces its change of quarters to 333 West 52d St., New York City. This move also includes the company's subsidiary, the **Diamond Core Bit and Tool Co.**

Enlarging its field of service to Canadian industry, **Mine Safety Appliances Company of Canada, Ltd.**, announces acquisition of a new building at 139 Kendal Ave., Toronto, where a broad line of approved safety equipment will be quickly available in meeting the ever-growing requirements of the Dominion's industrial and mining enterprises. **R. Morris** is general manager.

Sauerman Bros., Inc., Chicago, announce the removal of their general offices from 438 South Clinton St., to 522 South Clinton St., Chicago, Ill.

E. D. Bullard Co., safety equipment manufacturers, announces its Los Angeles and Denver offices have moved to larger quarters in the same cities. The Los Angeles office, managed by **Alton A. Castle,** is now located at 1213 South Olive, and in Denver at 56 Wazee Market with **Tom Hallinan** in charge.

Jenkins Bros., 80 White St., New York, N. Y., announces that it has materially increased productive capacity of its line of corrosion-resisting alloy valves.

Pomona Pump Co. announces the purchase of the **Westco Pump Division of Micro-Westco, Inc.**, Bettendorf, Iowa. The newly acquired business will be operated as Pomona Pump Co., Westco Division, at 2621 Locust St., St. Louis, Mo., and manufacture continued from the St. Louis plant of the Pomona Pump Co.

The directors of **Morris Machine Works,** Baldwinsville, N. Y., manufacturers of centrifugal pumps, hydraulic dredges and steam engines, announce the election of **Stuart J. Saks** as president of the company.

Substantial increases in sales of **PMG Hardener** are reported by the American manufacturers, **Phelps Dodge Copper Products Corp.**, according to a recent statement by **Wylie Brown,** president of the corporation. PMG Hardener is used in place of tin in the production of bronze castings, some of which in the past have contained as much as 10 percent tin.

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WHEAT

The Engineered Cap Lamp

12 *Reasons why*

1 Two bulbs (one for emergencies) — miner is never in the dark.
2 Center mounted, Krypton-filled bulb, gives 20% more light — no dark "shadow spot" in beam.
3 Choice of 3 reflectors gives narrow concentrated beam, a medium beam, or a widespread beam of light — suits all working conditions.
4 Headpiece weighs less than 6 ounces, Lamp Cord 6 ounces, Battery 62 ounces — Total weight of Lamp complete 74 ounces.
5 Headpiece molded of strong bakelite; sealed, moisture-proof and dust-proof.
6 Rubber battery case — non-conductor of electricity — a valuable safety feature.
7 Battery solution (free) limited to one ounce total both cells.
8 Lead-acid type battery maintains high voltage throughout shift (80+% efficiency) — year after year.
9 Battery charged through headpiece and cord of cap lamp — a daily test of all connections.
10 Designed for self-service charging system for lowest lamp-house operating cost.
11 To charge, headpiece is simply slipped on to key in charging rack, and turned to make contact. Nothing to take apart — unit-sealed construction.
12 A payment plan (purchase or rental) to meet the requirements of companies — large and small.

Note — More New Wheat Cap Lamps were installed in the U.S.A. during 1940-1941 than in any previous 2-year period

SPECIALISTS IN MINE LIGHTING FOR 23 YEARS

KOEHLER MFG. CO.

Marlboro · · · Mass.

WESTERN U.S.A.: E. D. BULLARD CO., SAN FRANCISCO, CAL.
CANADA: H. C. BURTON & CO., HAMILTON, ONTARIO

BETTER LIGHT—LESS WEIGHT
NON-SPILLABLE

Super Duty
DIAGONAL DECK
No. 6
CONCENTRATOR TABLE

DEISTER DIAGONAL DECK OVERSTROM

ENJOYS UNPRECEDENTED FIELD ACCEPTANCE

The imposing and ever increasing list of Super-Duty table placements, substantiating leadership, is convincing proof that this is your *profit process* in concentrating metallic and non-metallic minerals.

Check the performance and modern features of this table in the field. *Installation list furnished on request.*

THE DEISTER CONCENTRATOR COMPANY

The Original Deister Co., Incorporated 1906

903 Glasgow Ave. Ft. Wayne, Ind., U. S. A.

NEW BOOKS

THE DEVELOPMENT OF MINERAL INDUSTRY EDUCATION IN THE UNITED STATES. *By Thomas Thornton Read. The American Institute of Mining and Metallurgical Engineers, New York, 1941. Pp. 298. $2.*

MADE POSSIBLE by the Seeley W. Mudd Memorial Fund of the A.I.M.E., this interesting volume by Dr. T. T. Read came as a special year-end dividend to those who are interested in mineral industry education. It is a dividend which is just as welcome as and far more permanent in its effects than any special dividend ever received. As Herbert Hoover says in the foreword, "Professor Read has done honor to the profession and has contributed to strengthen its foundations by this book."

In passing it may be said that a foreword by Mr. Hoover is most appropriate for many reasons, but especially because it was Herbert and Lou Henry Hoover who made available to us Georg Bauer's "De Re Metallica," more commonly referred to as "Agricola". For it was with the publication of this, "the first work, in any language, specifically intended to be of aid in acquiring a knowledge of mineral industry techniques," that, as Dr. Read puts it, "the learning of mineral technology . . . entered upon what may be called its literate stage." In the words of Mr. Hoover, "Chained to the altars of the churches in the days of the Spanish Conquest, it ('De Re Metallica') was translated and expounded by the priests of the first Spanish miners. Here, perhaps, first began technical education."

Skillfully has Dr. Read traced the beginnings of education for the mineral industry, first in Europe and then in America. It may be surprising to many to learn how early this educational program began—long before "engineering" was recognized, long before the Industrial Revolution. In the United States, even before the founding of our first engineering schools, there were mentions of the need for education in the field of mineral technology.

With such a background the author has given a splendid picture that is just what its title indicates. The skill of historical research, the keen discernment of an engineer of broad training and wide experience, the interpretative ability of a scholar have all been used in painting this picture. Names of men and institutions, dates, interesting incidents, causes and effects, have been searched out, evaluated, and combined. The result is a book that has a wide appeal to anyone who has had contact with a mining school or who is interested in the problems of technological education.

To say that this book constitutes an important chapter in the history of technical education is quite true—but it is much more than this. It is the family tree of the educational side of a great profession. It brings out in bold relief the names of great leaders in that profession, men who have had a large share in shaping it into its present form. It is living history, written with a virile, facile pen.

No one in the country could have done a better job than Dr. Read, and many of us wonder whether anyone but he could have done it at all. This book is an enduring monument to him whether you take it as plain history, as an interesting volume, or as a skillful and human tracing of the evolution of a great profession from the practical art of the Middle Ages. The Seeley W. Mudd Memorial Fund may take a just pride in having sponsored this outstanding addition to the literature of our profession.

A. C. CALLEN

OPTICAL MINERALOGY. *Second Edition. By Austin F. Rogers and Paul F. Kerr. McGraw-Hill Book Co., 330 West 42nd St., New York, Pp. 390. Price $3.75.*

THIS VOLUME'S predecessor was known as "Thin-Section Mineralogy," issued seven years ago by the present senior author. Change of title ensued, according to the authors, in recognition of the fact that the earlier book was being used in other forms of mineral identification with the microscope. The text still applies primarily to the original purpose and the general form of treatment remains the same. Some parts have been rewritten or reorganized to extend the usefulness of the book and various new diagrams have been added.

POSSIBLE ALTERNATES FOR NICKEL, CHROMIUM, AND CHROMIUM-NICKEL CONSTITUTIONAL ALLOY STEELS. *No. 5 in the series, Contributions to the Metallurgy of Steel. American Iron and Steel Institute, 350 Fifth Ave., New York. Pp. 143. Price 50c.*

FOUR NEW SERIES of alloy steels designed to make the nation's reserves of strategic metals go further are announced by the American Iron and Steel Institute in this pamphlet, released Feb. 7, which was prepared at the request of OPM, since succeeded by the War Production Board. In making the new steels, producers will use less virgin chromium and nickel, and more of these alloys in the form of scrap recovered from steel previously produced. To develop these steels, a group of metallurgists chosen from committees of the Institute, the S.A.E., and from alloy-manufacturing companies, devised hitherto untried chemical compositions, melted experimental heats, tested them thoroughly, and selected those which seemed suitable.

The placing of priority orders on nickel and chromium, because sufficient supplies were not available, made it necesary to develop alternates. Those presented embrace a series of carbon-molybdenum steels, manganese-molybdenum-steels, low chromium-molybdenum steels and low nickel-chromium-molybdenum steels. Use of these alternates, it is stated, may necessitate changes in methods of fabrication or heat-treatment or both, or in engineering design.

CANADIAN MINES HANDBOOK, 1942. *Northern Miner Press Limited, 122 Richmond St., W., Toronto. Pp. 248. Price $1.*

THIS HANDY REFERENCE BOOK is exactly like the previous annual editions, save that it has been brought up to date. As before, it segregates the principal companies (Part I, 197 pages) from the inactive and extinct companies which are given in a supplementary list. Part I is marked by extensive descriptions of the companies covered.

▼ ▼ ▼

PUBLICATIONS

RECEIVED

Annual Report of the Director of the Mint. Fiscal year ended June 30, 1941, including report on the production of the precious metals during calendar year 1940. For sale from Superintendent of Documents, Washington, D. C. Pp. 112, cloth. Price 15c.

Forsterite Olivine Deposits of North Carolina and Georgia. By Charles E. Hunter. Bulletin 41, North Carolina Division of Mineral Resources, Raleigh, N. Car. Pp. 117.

"Development of a Refractory Aggregate From Virginia Kyanite." By J. P. Sawyer and J. W. Whittemore. Bulletin of Virginia Polytechnic Institute, Blacksburg, Va. Pp. 37.

"Min & Chem." Initial number of new house organ of International Minerals & Chemical Corporation (Louis Ware, president), formerly known as International Agricultural Corporation, 20 North Wacker Drive, Chicago, Ill.

The Feldspar and Quartz Mining Industry in Canada in 1940 (including data on nepheline-syenite) Dominion Bureau of Statistics, Ottawa. Pp. 8. Price 25c.

Use of Washed North Carolina Kaolin as an Ingredient of Porcelain Bodies. By W. H. Earbart, Circular No. 42, Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Grades of Lake Superior Iron Ore Shipped by Lake (Cargo bill-of-lading rights), Season 1941. Lake Superior Iron Ore Association, 1170 Hanna Building, Cleveland, Ohio. Pp. 4.

"Valuation of Iron Ore Properties, St. Louis County (part of Mesabi and Vermilion Ranges), Minnesota." Compiled by Walter H. Borgen, County Auditor, Duluth.

Iron Men and Their Dogs. By Ferdinand C. Latrobe. An account of the century-old Bartlett-Hayward organization. Prepared for employees under the direction of Walter F. Perkins, vice president of Koppers Company and general manager of its Bartlett-Hayward Division, 2000 Koppers Building, Pittsburgh, Pa. Pp. 225. No price mentioned.

Gurley Manual of Surveying Instruments, 49th Edition. W. & L. E. Gurley, Troy, N. Y. Pp. 208. Price 50c.

Geophysics in War. By Dr. C. A. Heiland. This is the title of Vol. 37, No. 1, of Colorado School of Mines "Quarterly," published at Golden, Colo. Approximately 100 pages.

Accounting for Special Reserves Arising Out of the War. Accounting Research Bulletin 13, issued by American Institute of Accountants, 13 East 41st St., New York. Pp. 111–118.

State of Goiaz, Brazil, Map of. (31½ x 42½ in.) Issued by Division of Geology and Mineralogy, National Department of Mineral Production, Rio de Janeiro. No price stated. This is a geologic map, giving also the towns and other settlements, rivers, and mountains. Scale, 1:1,500,000.

Mercury Poisoning as a Mining Hazard

In underground operations as well as in plants where the metal is recovered or used workmen find it advisable to take precautions

WITH the increased demand for mercury incident to preparations for national defense, and the reduction in imports from some of the usual sources owing to war conditions, many small mines in the United States are now being worked that ordinarily would be unprofitable. As operating methods at most of these mines are more or less crude, the workers may be exposed to a serious health hazard from poisoning by mercury, especially where there is an admixture of native quicksilver. A similar situation arose during the first World War, when, according to A. Hamilton, acute mercurialism became so prevalent at some small mines that they had to be abandoned, although the men worked in 2-hour shifts (with 2 hours off between shifts), had every care (including hot sulphur baths), and were urged not to work too hard.

Safety engineers of the Bureau of Mines reported recently that 14 men at a mine in California who worked four days relining a rotary kiln developed more or less severe symptoms, particularly diarrhea, hemorrhages of the stomach, vomiting, dizziness, and headache. The job was a rush one, and the men worked in some heat and dust without respiratory protection or ventilation. All recovered except one man, who suffered severe after-effects. He had worked for the quicksilver-mining company for about three years.

Owing to greatly expanded domestic production (greater in 1940 than in any year since 1883) the hazard of mercury poisoning is greatly increased.

In industrial mercury poisoning the portals of entry to the body are usually the skin through exposure to the dust as it settles on the body or clothing, the respiratory passages through inhalation of mercury dust or vapor, and the gastrointestinal tract through swallowing with food or other substance taken into the mouth. Absorption of mercury metal through the skin is possible. The hazard from handling the metal, however, would be due to contamination of food, smoking materials, or other contact with the mouth by the mercury on the hands rather than by direct absorption of the mercury through the skin. Mercury enters the body by way of the skin chiefly through the sebaceous-gland openings; as the palms of the hands contain no sebaceous glands, little or no mercury will enter, despite sustained massage from work.

The three characteristic features of industrial mercurialism are stomatitis (inflamation of the mouth), psychic irritability, and muscular tremor. Sayers mentions two forms of stomatitis—subacute and chronic. The subacute type occurs in those who have worked around mercury for a short time. The mucous membrane of the cheeks and gums is swollen and redder than normal, and some cases show ulcers on the cheeks and gums. The chronic form appears in those who have worked around mercury for a number of years. In this type the gums recede from the teeth, exposing the roots. The teeth may become loosened and, in severe cases, lose their enamel and appear wrinkled and broken. At a later stage they fall out—especially the lower teeth.

Nervous System Affected

According to Ernst Holstein, the most important effect of industrial mercury poisoning is on the nervous system. The nervous symptoms may appear in chronic poisoning without signs of disease in the mouth or throat. He refers to the change in personality as outstanding among the manifold symptoms of mercurialism. In its severest manifestation it is characterized by heightened excitability, the medical term for which is erethism; this is a peculiar mixture of frightened embarrassment, perplexity, uncertainty, and dread.

Holstein states that tremor usually appears as a sequel to the erethism and the psychoneurotic symptoms; on the other hand, these morbid changes seldom appear without premonitory symptoms. Tremor usually begins in the fingers, then spreads to the hands and lower and upper arms. The lower extremities may be affected in the same manner; this is apparent first in unsteadiness in standing and walking or in trembling of the knees when standing upright. The head may roll about and the trunk make jerky movements. The facial musculature may move in unison with the other affected parts; the eyelids and nostrils may quiver, the outstretched tongue tremble, and the lower jaw move up and down.

Hypersensitivity to Mercury—Apparently exposure of some persons to mercury vapor renders them more susceptible to poisoning if exposed again even to low concentrations that originally would not have caused symptoms. A possible example of this is the severe after-effects suffered by one of the 14 men reported by Bureau of Mines engineers as poisoned by mercury while relining a rotary kiln. The occupation of the man in question was that of bricklayer, and he had worked three years for the quicksilver-mining company, which would be his exposure to mercury. All the men were more or less affected but all recovered except the one who had been exposed to mercury previously. He developed weakness, prostration, and loss of nervous and muscular coordination; his mouth was copper-colored, and jaws and mouth were sore. As he had false teeth the usual effect on the teeth was not apparent. He lost weight and had the usual nervous symptoms of irritability, depression and melancholy, avoidance of social contact, fine tremor of the extended tongue, and loss of strength of hand and fingers, which produced tremulous, illegible writing, even in signing his name, and became more marked when his attention was fixed in an attempt to reduce the effect.

In citing his personal experience with hypersensitivity to mercury, Stock states than ten years after cessation of his severe poisoning by the metal, exposure to as little as several tenths of a milligram to 1 mg. in a cubic meter of air in his laboratory caused chronic symptoms.

Treatment of Poisoning—According to Holstein the symptoms of mercury poisoning usually disappear gradually and in most cases completely after cessation of exposure, and convulsions are fatal only in the worst cases. The first step in treatment of chronic poisoning is to remove the patient from all contact with mercury. If possible, he should be kept free of any conditions that may disturb or excite him. He should remain in the open air as much as possible. At first he should rest, then take regular exercise and do work, such as gardening, to stimulate perspiration and hasten elimination of mercury from the body. All attempts to speed the elimination of mercury by medical means have failed. Hot baths are recommended but without addition of other substances such as sulphur.

Sayers has summarized methods of treatment as follows: To treat successfully industrial mercurial poisoning, it

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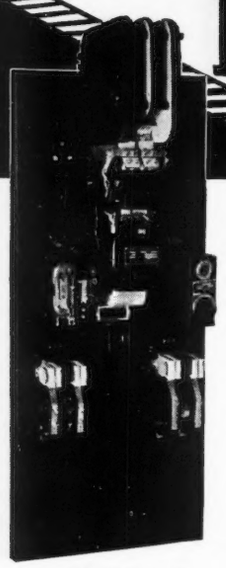

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is imperative that the patient be removed from all possibility of further exposure to mercury. The basis of the active treatment is elimination by stimulating the activity of the kidneys, the intestines, and the sweat glands. Magnesium citrate is a satisfactory cathartic in these cases. Large amounts of water should be taken for their effect on both the kidneys and intestines. Hot baths, sweat baths, and other hydrotherapeutic measures also are beneficial. Iodides usually are prescribed but, according to Schereschewsky (personal communication), are of doubtful value. The stomatitis and digestive disturbances should be treated according to the symptoms. Potassium chlorate solution and astringent mouth washes should be used. Massage is said to be of value in treating the tremors.

The general physical condition of the patient should be improved by an abundant diet of milk, eggs, cream, and other nutritious foods.

Eliminate the Source

Prevention of Poisoning—The first step in the prevention of mercury poisoning is to eliminate the source as much as possible. This can be done by preventing exposure of mercury to the air, as vaporization takes place rapidly at ordinary temperatures and to some extent at temperatures of solidification.

Mercury vapor is heavier than air, but it does not localize itself in the lower part of a closed space (the laws of gaseous mixtures differ from the laws of liquid mixtures). Vapor produced at a high temperature has a tendency to rise.

A. C. Giese found that 1 cubic meter of air saturated with mercury vapor at 25 deg. C. contains 19.5 mg. of mercury and that when a stream of air at 25 deg. C. passes over a surface of mercury 10 cubic meters square at the rate of 1 liter per minute it becomes about 15 percent saturated and will contain about 3 mg. of mercury per cubic meter.

The figures given indicate the toxic hazard that may be present when mercury is handled carelessly. Droplets of mercury scattered on the floor of the working place may vaporize into toxic amounts in a short time; therefore, every care should be taken to prevent spilling of mercury and to clean it up after it has been spilled. Floors should be made of cement or asphalt and should be free of cracks so that the mercury droplets can be removed easily and completely. Good ventilation (preferably mechanical) is necessary to remove the dust and vapor that inevitably contain some mercury wherever the metal or its compounds or ore is used or handled.

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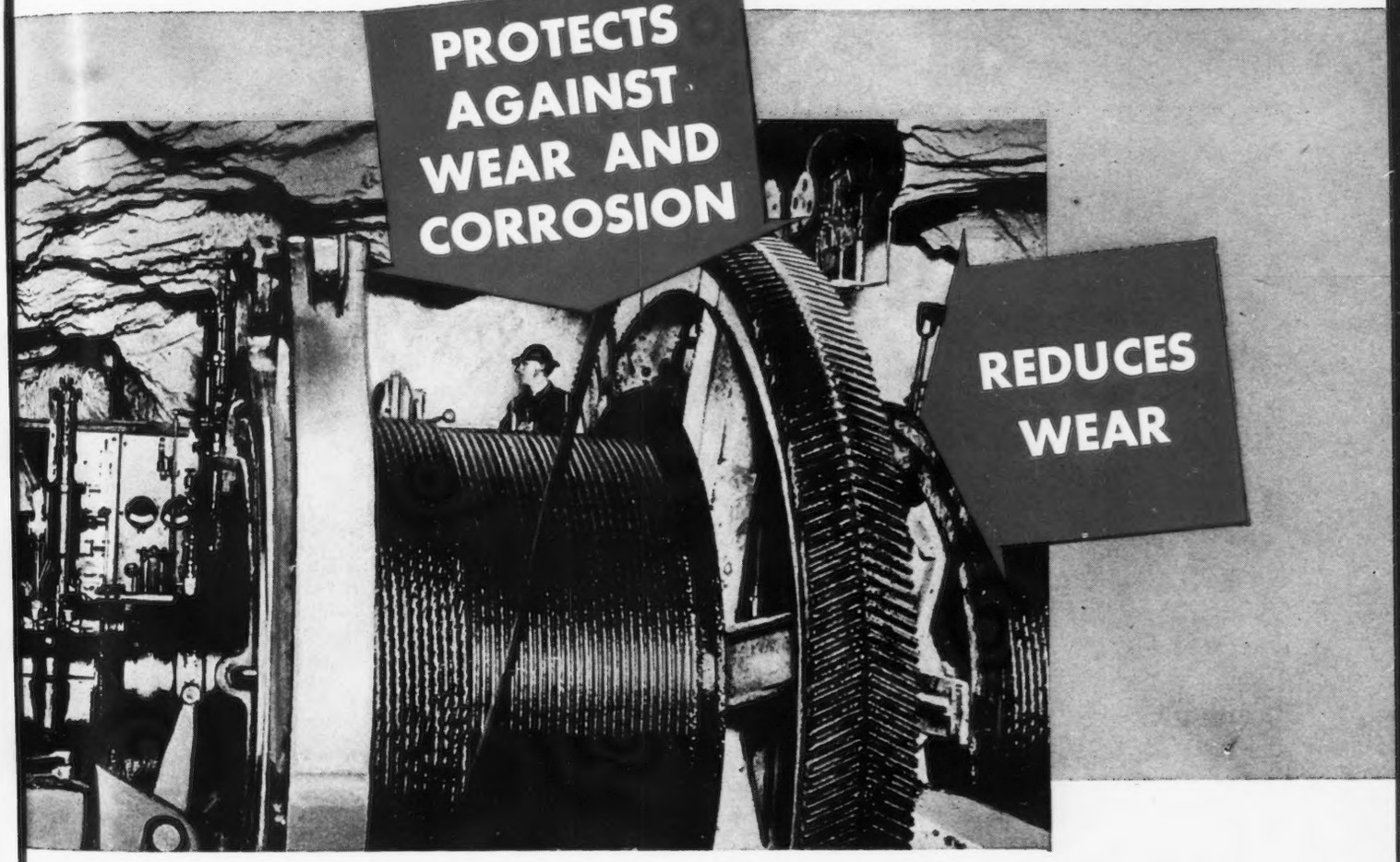

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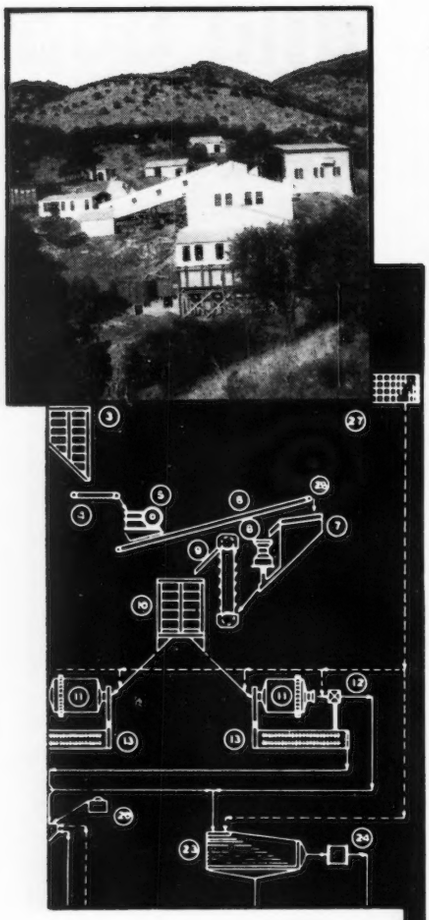

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retard to some extent the volatilization of the metal and thus reduce the possibility of poisoning. In hot mines the more or less harmless sulphide ore may be decomposed and enough mercury metal volatilized to cause poisoning. Mechanical crushers and the use of modern airtight furnaces, condensers, and retorts with enough negative pressure to prevent the escape of dust and fumes will prevent poisoning in the various processes of preparing and purifying the metal. However, perfect technique is required to prevent poisoning entirely. Care must be taken in ventilating factories and workshops that mercury-laden air does not contaminate the surrounding atmosphere and injure persons and animals in the neighborhood.

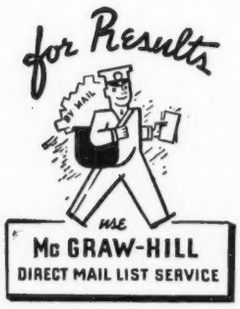
The following are some of the measures recommended by the Industrial Accident Commission of California for the prevention of poisoning in the mining and recovery of mercury:

Many mercury mines are very warm and enough air should be provided to create in the ventilating current a velocity that will have the required cooling effect. Another function of the ventilating air current is to remove dangerous gases or to dilute them to harmless proportions. It is therefore good practice to supplement the exhaust system with blowers placed with a view to augmenting the movement of fresh air toward the working faces of the mine.

In retort reduction plants, the principal hazards occur at the charging and discharging ends of the retorts and also the discharge ends of the condensers. In plants using the rotary type of furnace, the points of exposure are to be found at the feed chute and at the seal rings.

Fortunately, protection against the hazards of retorts and rotary furnaces is not difficult. Respiratory protection in the form of airline respirators and canister gas masks will protect operators of retorts, but such equipment should not be made to serve continuously instead of removing the conditions which cause the hazard. Leaking seal rings and feed chutes can be corrected by increasing the fan suction to insure in-draft at all joints and openings. If there is some loss of mercury, the cure is not in reducing the suction but in obtaining additional condensing capacity.

Hoeing tables are bad offenders from the standpoint of health hazard. Some attempts have been made to equip such tables with exhaust ventilation. Most of them are not efficient, because of poorly designed hoods, inadequate fan capacity, and failure to take advantage of the fact that mercury vapor, being nearly seven times heavier than air, tends to drop—not to rise. Hoods would serve better if designed to pull the vapors to lateral ducts rather than attempt to draw them to a duct in the top of the hood.



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Precautions that will reduce the number and severity of cases of mercury poisoning have been summarized by Sayers as follows:

1. The working places should be ventilated, preferably by mechanical means, so that there is always an abundant supply of fresh air.

2. Exhaust ventilation for the shaft furnaces, condensers, and retorts should maintain sufficient negative pressure within them to prevent the escape of fumes and dust at all times.

Respirators Desirable

3. The workers should be supplied with respirators, which should be worn whenever it is necessary to be in mercury dust or fumes.

4. Change and bath houses, equipped with showers (one for every ten employees), wash basins or taps (one for every five employees), and an individual locker for each employee should be provided. Each locker should be arranged in two compartments, one for ordinary clothing and the other for street clothing.

5. Lunch rooms should be located convenient to working places and the depositing or eating of food should not be permitted except in the lunch room.

6. Physical examination should be made of all applicants for employment, and those addicted to drunkenness, those having tuberculosis, those in poor physical condition, and those under 17 years of age should not be permitted to work where they will be exposed to mercury in any way.

7. Physical examination of all employees should be made at least once every six months and before returning to work after any illness, and those suffering from mercurialism or those in poor physical condition should be removed from work exposing them to the poisoning.

8. Every employee should be told of the dangers of mercury poisoning and instructed how best to avoid them. This should be done by a responsible person, especially designated for the purpose by the general manager. The employee should be further instructed by the foreman of the work to which he is assigned, on how to avoid the dangers inherent in the work.

9. As personal cleanliness and personal hygiene are important factors in preventing mercury poisoning, the following instructions should be impressed upon each workman:

a. Wash your hands carefully before eating or handling anything that will be placed in the mouth.

b. Always rinse your mouth before taking a drink or eating.

c. Drink water and milk plentifully.

d. Never go to work without having eaten a substantial meal. With an empty stomach, conditions are more favorable for the absorption of mercury into the body.

e. Take a hot shower bath, using soap, at the end of each day's work.

f. Change your ordinary clothing for work clothing before going to work, and work clothing for ordinary clothing at the end of work. Work clothing should cover the body well, and be tight fitting at the ankles, wrists, and neck. A close-fitting cap or hat should be worn. The work clothing should be washed frequently—at least once a week.

g. When passing to the leeward of fumes, hold your breath as much as possible. Pass to the windward wherever possible. When necessary to be in fumes or dust, wear a respirator at all times.

h. After having been in fumes, dust, or soot, wash the exposed parts of the body, hands, and face, and rinse the mouth well at the first opportunity.

i. Do not allow yourself to become constipated. Regular habit in this regard is much more important than cathartics. Train yourself to be regular. lar.

j. Care of the teeth and gums is most important. They should be kept clean and healthy. They should be examined at least once every six months by a dentist and his recommendations followed.

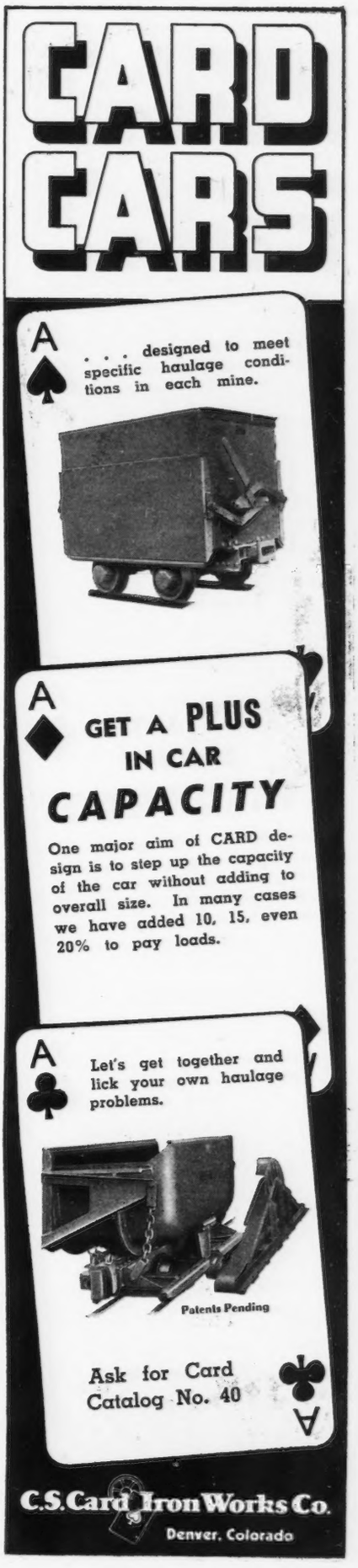
k. If you feel at all sick, consult the doctor at once.

Some Tables Replaced

Tables have been replaced in some plants by mechanical hoers. This lessens the danger of poisoning by reducing the period of exposure. In cleaning and washing down condensers, the operator should wear respiratory protection and rubber gloves and in all operations, both in the mines and in the plants, men should be particular in the matter of personal cleanliness, especially before eating. Smokers, and especially those who "roll their own," are in danger from inhaling contaminated tobacco smoke.

A new method of preventing mercury poisoning has recently been tried by the management of a mine in California which was about to be closed on account of the large number of cases of salivation and high turnover (450 percent a month) of employees. A spray solution used in agriculture is said to settle the mercury vapor and form a coating on the metal that renders it inert. The results so far are encouraging, no signs of mercury poisoning having developed in this mine during the three months the spray has been in use. (This new method will be described in a special article in the April issue by Thomas Soule, chief engineer of Industrial Indemnity Exchange, San Francisco—Editor.)

Excerpted from Information Circular 7180, by S. J. Davenport and D. Harrington, Bureau of Mines, Washington, D. C.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